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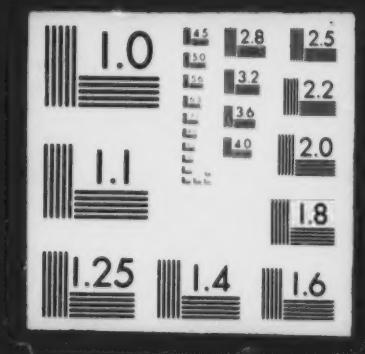

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PROGRAMMED DEMONSTRATION FOR EROSION AND SEDIMENT CONTROL SPECIALISTS

MARYLAND STATE WATER RESOURCES ADMINISTRATION

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY
HITTMAN ASSOCIATES, INCORPORATED

FEBRUARY 1974

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16. ABSTRACT
A series of technical presentations and a certification plan for erosion and sediment control specialists are presented. Fifteen conventional presentations, complete with visual aids and student handouts, and six audiovisual programs consisting of film strips, taped narration, work books, and instructor's manuals are described. Samples of the presentation materials, designed to provide an effective program for qualifying construction personnel and other persons to pass the certification exam, are included in appendices. Presentations include such topics as: Goal, Objectives and Principles of Erosion and Sediment Control; Erosion and Sedimentation; Control of Sediment Generated on Construction Sites; Control of Runoff During Construction; Vegetative Soil Stabilization; and Foreman-Inspector Responsibilities. Results of a demonstration to evaluate the conventional presentation approach versus the audiovisual approach are given. Also described is the development of a plan for the certification of on-site erosion and sediment control specialists.

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PROGRAMMED DEMONSTRATION FOR EROSION AND SEDIMENT CONTROL SPECIALISTS

By

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State of Maryland
Annapolis, Maryland

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Project No. S800854 (15030 FMZ)
Program Element 1B2042
Roap/Task PEMP 03

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Prepared for
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U. S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D. C. 20460

ABSTRACT

This project consisted of the development of a series of technical presentations and a certification plan for erosion and sediment control specialists and the demonstration and evaluation of two alternative approaches for presenting information on topics relating to erosion and sediment control.

Fifteen technical presentations were prepared. They consisted of a script, visual aids, and a student handout. Six of these presentations were converted to audiovisual presentations for comparison with the conventional technical presentations. Each audiovisual presentation consisted of one or more cassettes containing a narration on a magnetic tape and a synchronized film strip, a workbook, and an instructor's manual.

This report, as well as accompanying copies of the presentations, under separate cover, was submitted in fulfillment of Grant No. S800854 (15030FMZ) by the Water Resources Administration, State of Maryland, under the partial sponsorship of the U. S. Environmental Protection Agency.

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This final report for the "Programmed Demonstration for Erosion and Sediment Control Specialists" was prepared under joint sponsorship of the U. S. Environmental Protection Agency and the Water Resources Administration, State of Maryland, by Hittman Associates, Inc. of Columbia, Maryland. Sincere thanks are extended to Donald J. O'Bryan, Acting Chief, Mining and Land Modification Branch, EPA, and John J. Mulhern, Project Officer, EPA, for their support and guidance throughout the demonstration program.

Special thanks goes to members of the Water Resources Administration, State of Maryland, especially Marshall T. Augustine, Roger A. Kanerva, Roy E. Benner, and Albert E. Sanderson, for their technical guidance and editorial help. Additional gratitude is extended to Roger A. Kanerva and Roy E. Benner for their assistance in writing presentations.

The contributions provided to this program by the use of 35 millimeter photographic slides from the U. S. Department of Agriculture, the Maryland Water Resources Administration, Mr. Marshall T. Augustine, the Maryland State Roads Commission, the Soil Conservation Service, the soil and water conservation districts of Howard, Montgomery, and Prince Georges counties in Maryland, the Baltimore Public Works Commission, and Rummel, Klepper, and Kahl, Consulting Engineers in Baltimore are also acknowledged with sincere thanks.

SECTION I
CONCLUSIONS

1. Sediment & erosion control specialists who participated in the audiovisual presentations scored higher on a test than a similar group of persons who viewed the same presentations in a conventional, lecturer type format.

2. From statistical analyses, it can be concluded that the audiovisual presentations were certainly as effective as the conventional presentations.

3. Participants preferred the audiovisual approach over the conventional approach.

4. The six audiovisual presentations comprise a coherent, abbreviated program that can be effectively utilized at the present time and later integrated into an expanded audiovisual program.

5. The 15 conventional presentations provide a comprehensive exposure to all of the major aspects of erosion and sediment control.

6. The State of Maryland should adopt a certification program requiring contractors engaged in grading activities to have an on-site certified specialist in charge of the implementation of the sediment control plans.

7. Only construction sites requiring a "standard" sediment control plan and those not requiring a plan should be excluded from the certication requirement.

8. An interim certification should be issued in Maryland with experience being the only qualifying criteria.

9. A full certification should be required within two years of the adoption of a certification requirement. Experience, plus the passing of a written or oral exam, should be the primary qualifying requirements.

10. The presentation materials developed in this demonstration will constitute an effective program for qualifying construction personnel and other persons to pass the certification exam.

11. The Department of Natural Resources, State of Maryland should administer the certification program under a board appointed by the Secretary of the Department of Natural Resources.

SECTION II
RECOMMENDATIONS

Combine the presentations on "Climatology, Hydrology and Hydraulics" and "Rainfall-Runoff Relationships" into one presentation entitled "Hydrology" and convert it into the audiovisual format.

Convert the following existing presentations into the audiovisual format:

Presentation No. 2 - Soils
Presentation No. 6 - Plant Materials
Presentation No. 9 - Erosion and Sediment Control Planning
Presentation No. 11 - Wooded Site Development
Presentation No. 12 - Temporary Soil Stabilization
Presentation No. 13 - Prevention of Waterway Erosion

Do not convert Presentation No. 14 "Sediment Control Laws and Regulations for the State of Maryland," into the audiovisual format.

Write a general presentation on "Stormwater Management" and a presentation on the "Universal Soil Loss Equation" and convert them into the audiovisual format.

Prepare an audiovisual presentation on "Vegetative Soil Stabilization" for each of the major plant growing regions in the country.

The conventional presentations should be given in the following order:

(1)	Presentation No. 1 -	Goal, Objectives and Principles of Erosion and Sediment Control
(2)	Presentation No. 2 -	Soils
(3)	Presentation No. 3 -	Climatology, Hydrology and Hydraulics
(4)	Presentation No. 4 -	Rainfall-Runoff Relationships
(5)	Presentation No. 5 -	Erosion and Sedimentation
(6)	Presentation No. 6 -	Plant Materials
(7)	Presentation No. 8 -	Control of Runoff During Construction
(8)	Presentation No. 10-	Vegetative Soil Stabilization
(9)	Presentation No. 13 -	Prevention of Waterway Erosion
(10)	Presentation No. 12 -	Temporary Soil Stabilization
(11)	Presentation No. 7 -	Control of Sediment Generated on Construction Sites
(12)	Presentation No. 9 -	Erosion and Sediment Control Planning
(13)	Presentation No. 11 -	Wooded Site Development
(14)	Presentation No. 14 -	Sediment Control Laws and Regulations for The State of Maryland
(15)	Presentation No. 15 -	Foreman-Inspector Responsibilities

The audiovisual presentations should be given in the following order:

(1) Goal, Objectives and Principles of Erosion and Sediment Control.

(2) Erosion and Sedimentation

(3) Control of Runoff During Construction

(4) Vegetative Soil Stabilization

(5) Control of Sediment Generated on Construction Sites

(6) Foreman-Inspector Responsibilities

Adopt a certification program for erosion and sediment control specialists in the State of Maryland.

Exclude government inspectors from requiring a certification to perform erosion and sediment control inspections.

Issue interim certifications based on experience for two years prior to requiring a full certification, which would involve the passing of an exam.

Administer the certification program in the Department of Natural Resources, State of Maryland, utilizing a professional board appointed by the Secretary of the Department.

SECTION III
INTRODUCTION

This project, the "Programmed Demonstration for Erosion and Sediment Control Specialists," was performed under an Environmental Protection Agency demonstration grant to the Water Resources Administration, State of Maryland. Hittman Associates, Inc., of Columbia, Maryland, was the prime contractor for the project.

The purpose of the project was to develop a series of presentations on sediment and erosion control and a certification plan for erosion and sediment control specialists, utilizing technology developed on EPA Grant No. 15030FMZ, and to demonstrate its workability. This primarily involved the development of 15 presentations on various topics relating to erosion and sediment control, the conversion of 6 of these presentations into the audiovisual format, the demonstration of the program, and the evaluation of the audiovisual approach against the conventional technical presentations with slides.

In developing the demonstration program, full use was made of the information gathered on the "Joint Construction Sediment Control Project", EPA Grant No. 15030 FMZ, conducted for the State of Maryland by Hittman Associates. The field demonstration program funded under that project was continued in this project for the purpose of acquiring demonstration materials for use in developing the slide and audiovisual programs.

Although the demonstration program was developed for the State of Maryland, it was anticipated that there would be a nation-wide need for such a program. Accordingly, it leans heavily towards general philosophy and universally applicable principles and practices. Only two presentations, "Vegetative Soil

Stabilization" and "Sediment Control Laws and Regulations for the State of Maryland", are directed primarily towards Maryland and other states with physiographic similarities or similar institutional arrangements.

Due to space limitations, the presentation materials were not included in this report. Instead, copies of all materials were delivered under separate cover to the project officer. Samples are included, however, in the Appendices.

SECTION IV
DEVELOPMENT OF PRESENTATIONS

GENERAL

The primary effort of this program was the development of 15 conventional presentations, complete with visual aids and student handouts, and six audiovisual programs consisting of film scripts, written scripts, work books, and instructor's manuals.

This work involved the taking and collection of over 4,000 separate 35 millimeter color and black and white photographic slides, the contributions of several writers, both from Hittman Associates and the Maryland Water Resources Administration, and very close coordination between both parties and the audiovisual subcontractor for technical review of program material.

CONVENTIONAL PRESENTATIONS

The topics for 15 conventional presentations (see Appendix "A" for presentation sample) were selected so as to provide an integrated program, rather than a series of presentations on random topics relating to erosion and sediment control. However, each presentation was written so that it would entirely, or in large part, stand by itself. In setting up the program the presentations were grouped under three categories - Basic, Specialized, and General. The breakdown is as follows:

1. Basic Presentations

   Presentation No. 1 - Goal, Objectives and Principles of Erosion and Sediment Control

Presentation No. 2 - Soils

Presentation No. 3 - Climatology, Hydrology and Hydraulics

Presentation No. 4 - Rainfall-Runoff Relationships

Presentation No. 5 - Erosion and Sedimentation

Presentation No. 6 - Plant Materials

2. Specific Presentations

Presentation No. 7 - Control of Sediment Generated on Construction Sites

Presentation No. 8 - Control of Runoff During Construction

Presentation No. 10 - Vegetative Soil Stabilization

Presentation No. 12 - Temporary Soil Stabilization

Presentation No. 13 - Prevention of Waterway Erosion

3. General Presentations

Presentation No. 9 - Erosion and Sediment Control Planning

Presentation No. 11 - Wooded Site Development

Presentation No. 14 - Sediment Control Laws and Regulations for the State of Maryland

Presentation No. 15 - Foreman-Inspector Responsibilities

The "Basic" category treats the introductory and background aspects of erosion and sediment control and provides the participant with the basic knowledge to more fully comprehend the "Specialized presentations. The

"Specialized" category covers the actual techniques for controlling erosion and sedimentation. The "General" category is intended to provide the participant with the general knowledge required to implement the total program of erosion and sediment control and to make him aware of his importance and function within the control framework.

In addition to the writing of the presentation material, erosion and sediment control products and practices were demonstrated in Columbia, Maryland for the purpose of obtaining photographs for use as visual aids.

The desired method of operation in preparing the conventional presentations was to write the script, complete with recommended visual aids, have it reviewed by the Maryland Water Resources Administration, and then to collect the visual aids and write the student handout. (see Appendix "B" for a sample student handout) To speed progress, photography was often performed concurrently with the writing of the script. Unfortunately, this method of operation was not possible for all of the presentations, in that the writing was performed during the winter months when pertinent construction activity had stopped. This necessitated the taking of numerous pictures during the preceding summer and fall in anticipation of requirements for the winter. In that it was impossible to fully anticipate the requirements, it became a particularly difficult task to obtain many of the slides. Solving the problem required the gathering of slides from outside collections, the use of captions and artwork, staging, and, in the more difficult situations, reworking the script to accommodate the available slides.

Experience showed that it is very difficult to gather pictures of good practices in an emerging field such as erosion and sediment control. The opportunities to gather slides to prepare a "horror story" type of presentation were abundant, but the same was not true of gathering visuals to prepare the "how

to do it" type of presentations developed in this demonstration. To obtain the proper visuals, considerable field searching was required, as well as costly staging operations and artwork.

The length of the presentations varied depending upon how much information had to be presented. The lecture time varied from approximately 30 minutes for Presentation no. 1 up to about 75 minutes for Presentation No. 10.

The number of slides used in the presentations ranged between 47 and 104. In all, over 1,100 slides were used in the 15 conventional presentations.

Final Product

As noted earlier, the materials for each conventional presentation consisted of a narrator's script, visual aids, and a participant's handout (see Appendices). Each script contains a content outline and the complete narration of the presentation (see Appendix "A" for a sample script). To provide for the synchronization of the visual aids with the narration, reference was made to the required visual in the script. The visual references were numbered consecutively and a brief description of the subject matter was provided.

All visual aids consisted of 35 millimeter color or black and white slides (see Appendix "A" for sample of visuals). The slides for each presentation were packaged in clear plastic storage sheets, each accommodating 20 slides. The slide sheets, scripts, and other presentation material were assembled in standard three ring notebooks. Each slide was marked in the upper right hand corner with the presentation number and the sequence number. The use of the number 8-3, for example, refers to Presentation No. 8 and the third slide to be shown.

The participant's handouts contain the important information covered in the narrator's script, grouped under topical headlines (see Appendix "B" for a sample handout).

AUDIOVISUAL PRESENTATIONS

The six audiovisual presentations were prepared by Educational Communications, Incorporated of Wayne, Pennsylvania with technical assistance from Hittman Associates and the Maryland Water Resources Administration. Educational Communications' work was performed under contract with Hittman Associates.

The six conventional presentations converted into audiovisual presentations are as follows:

Presentation No. 1 -	Goal, Objectives and Principles of Erosion and Sediment Control
Presentation No. 5 -	Erosion and Sedimentation
Presentation No. 7 -	Control of Sediment Generated on Construction Sites
Presentation No. 8 -	Control of Runoff During Construction
Presentation No. 10 -	Vegetative Soil Stabilization
Presentation No. 15 -	Foreman-Inspector Responsibilities

Two criteria were used in selecting the presentations for conversion into the audiovisual format. First, the presentations were chosen so as to make up a coherent, abbreviated package that could be used immediately and then later be integrated into an expanded program, including nearly all of the remaining presentations not yet converted into the audiovisual format, and any other presentations that may be developed. The second selection criteria was that all three of the presentation categories be represented. Presentations No. 1 and No. 5 came from the "Basic" presentation category,

Presentations No. 7, No. 8, and No. 10 from the "Specific" category, and Presentation No. 15 from the "General" category.

The first steps in the development of the audiovisual presentations were to define the target population, general performance objectives, and terminal behavior, and to select the audiovisual hardware.

Characteristics of Target Population

It was decided by The Water Resources Administration , State of Maryland , that the presentations would be made available to private contractors and governmental pollution control agencies. The target population within these two sectors was defined as construction foreman and inspectors. It was assumed that the personnel within these categories would have completed a high school education. It was further assumed that the construction foreman were well versed in practical procedures for translating engineering designs into structures on the construction site. The governmental inspectors, on the other hand, were assumed to have had less construction experience and the inability, in most cases, to translate engineering designs.

General Performance Objectives

A foreman who studied the audiovisual presentations was expected to acquire the following abilities:

1. To be able to look at a plan and visualize it functionally on the site.
2. To be able to schedule the work so measures to prevent runoff are coordinated with other construction.
3. To recognize various control structures on the plan and transfer these to the site.

4. To understand his role and responsibilities and his relationship with government inspectors.
5. To determine whether the proposed plan will perform adequately on the site and be able to go back to the designer with recommendations for changes if needed.

A government inspector taking this program was expected to develop the following abilities:

1. To understand his role and responsibilities.
2. To understand the cross relationship between himself and the contractors' foreman.
3. To determine if the construction site is in compliance with the plan and if it will effectively control runoff.
4. To be able to report on the reasons for problems and make proposals for their correction.
5. To be able to make a decision as to what recommendations he can make and what changes must go back for re-design and approval.
6. To be able to prepare effective reports concerning each particular situation.

Terminal Behavior

The terminal behavior determined at the outset of the development of the presentations was twofold:

1. At the conclusion of each of the audiovisual programs, trainees will be required to complete a written test. These tests will incorporate various forms of questions relating

directly to the subject matter just covered. It will be expected that 90 percent of the participants will score a correct response on 90 percent of the questions.

2. As a more long term requirement of this project, it is expected that participants will gain increased motivation to perform their assigned tasks efficiently and cooperate with all those charged with the responsibility of reducing erosion damage.

Audiovisual Hardware

It was decided that the audiovisual equipment should have the following characteristics:

1. Be able to present filmstrips which are automatically synchronized to the sound.
2. Have the sound tape and filmstrip enclosed in one integral cassette.
3. Have the capability of being used as a front screen projector which could be viewed by groups of approximately 15 persons.
4. Be capable of conversion to a rear screen projector for individual viewing.
5. Be small and compact enough for an individual to take home.

Several brands of audiovisual equipment were evaluated by Hittman Associates and the Maryland Water Resources Administration. The audiovisual projectors manufactured by Audiscan Incorporated in Bellevue, Washington were selected for use in the program (see Figure 1).

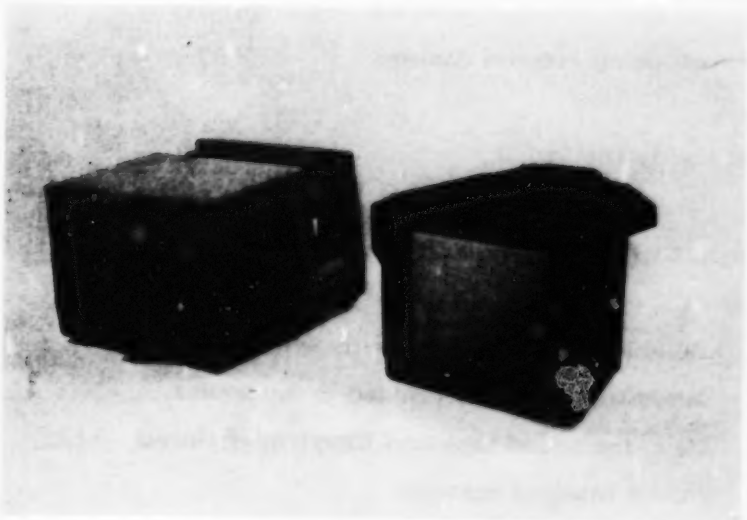

Figure 1. Audiovisual machine used in the demonstration. Adjacent screen can be attached for individual or small group use.

Program Development

Hittman Associates provided the audiovisual subcontractor, Educational Communications, Incorporated, with conventional presentations from which to develop the audiovisual scripts (see Appendix "C" for a sample audiovisual script).

Before writing the script for any presentation, specific performance objectives were determined. In the presentation entitled "Control of Sediment Generated on Construction Sites", for example, the participant was expected to be able to accomplish the following things after viewing the presentation.

1. Explain the basic principles of sediment traps.
2. Describe and detail the use of graded vegetated buffer areas.
3. Explain the importance of leaving natural vegetative buffers.
4. Describe the use of contour stripping.
5. Explain the use and construction of sod inlet filters.
6. Explain the use and construction of gravel inlet filters.
7. Describe the use of the sandbag sediment trap.
8. Explain how the straw bale sediment trap is used.
9. Detail the use of the straw bale perimeter barrier.
10. Describe the use of the excavated sediment trap.

11. Distinguish between wet and dry sediment basins and the use of each.

In writing these scripts each unit of information was broken into segments not exceeding approximately 30 words. This formed the descriptive narration for the presentation. Each narration segment was accompanied by the description of a visual or a "frame". These visuals were specified as either photographs, artist sketches, or title boards.

The format used for all presentations consisted of first introducing the theme, then presenting a unit of information. The information unit was then followed by a break during which participants were asked to respond to questions in the workbook (see Appendix "D" for a sample workbook). After all units of information had been covered, a summary of the material was presented as a review.

Each presentation had a specific theme. For example, the presentation on "Vegetative Soil Stabilization" featured Augie the Worm; "Foreman-Inspector Responsibilities" featured Sherlock Holmes and Doctor Watson as a team of great men, and "Control of Sediment Generated on Construction Sites" featured pre-historic villagers.

As each script was completed it was subject to a word by word critical review by representatives of Hittman Associates and of the Maryland Water Resources Administration. Changes were made to increase clarity and correct any possible misconceptions.

Suitable photographs to illustrate the concepts described in each visual frame were selected, where possible, from the extensive library developed by Hittman Associates. In a number of cases new on-site photographs had to be

taken to illustrate specific concepts and in the script "Foreman-Inspector Responsibilities" role play situations were photographed.

Where it was not possible to obtain suitable photographs, Educational Communications had their artist produce color illustrations. This art work was also fully reviewed by the reviewing committee composed of personnel from Hittman Associates and the State of Maryland. Upon approval, it was photographed on 35 millimeter slides.

When all photographs of artwork and field photographs were selected, they were arranged in sequence and projected for the review committee. The committee not only ruled on the suitability but also suggested appropriate cropping where needed. All slides were then copied onto a master filmstrip.

The written narration for the various presentations was read by several different narrators. Suitable music was mixed into the presentations where needed. When the recorded sound track had been approved, the tapes were impulsed with inaudible signals to change the visuals and to stop the presentation when participants were to go to the workbooks.

Final Product

Each audiovisual presentation was packaged in plastic cassettes containing both a magnetic tape sound track and a synchronized 16 millimeter film strip (see Figure 2).

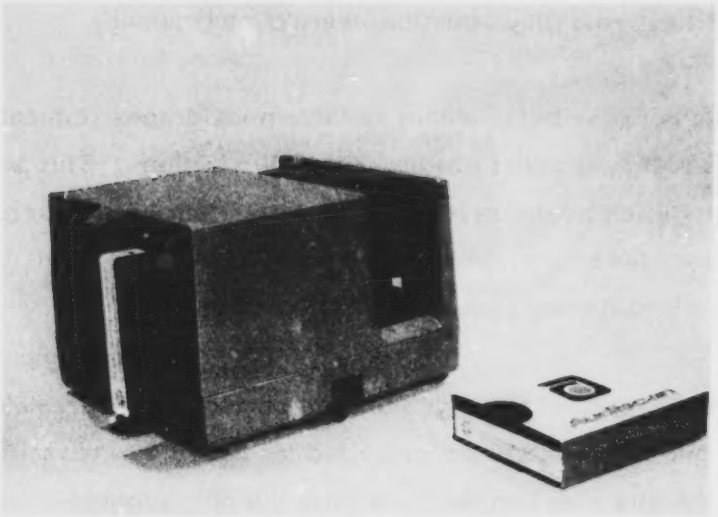

Figure 2. Cassettes containing a magnetic tape sound track and film strip, and an audiovisual machine, with inserted cassette, ready to operate

Each cassette has a running time of approximately 15 to 20 minutes. Two of the presentations required only one cassette to present the information, two others required two cassettes, and the remaining two required three.

It is estimated that the total time required to present each cassette is about 30 minutes. This provides for workbook exercises and discussions.

Workbooks were also prepared for the audiovisual presentations (see Appendix "D" for a sample workbook). These were designed to serve as an additional reinforcement and as a reference document that the participant can retain. In addition to containing questions to be answered at each

workbook stop during the program presentation, the workbooks contain a review test, and a descriptive outline of the subject matter.

To assist the supervisor in giving the programs a manual was prepared for each program (see Appendix "E" for a sample manual). These documents contain information on how to set up the program and operate the audio-visual machines, list the primary objectives of the program, provide a listing of suggested discussion topics, and contain the answers for all of the questions in the participant's workbook.

Audience

The audiovisual programs were designed primarily for use by participants in small groups of up to 15 people with a knowledgable supervisor in attendance. It was also anticipated that on occasions an individual would be asked to study the programs by themselves.

The equipment selected for use in the demonstration has the capability of being connected to a standard 35 millimeter, carrousel type projector for use by large audiences. The sound track can still be used, but instead of the standard 16 millimeter film strip, 35 millimeter slides are used for visuals (see Figure 3).

Figure 3. Audiovisual machine connected to a carrousel type projector for showing to a large audience.

SECTION V
PROGRAM DEMONSTRATION AND EVALUATION

GENERAL

As part of the program, a demonstration was conducted to evaluate the conventional presentation approach versus the audiovisual approach. As visualized, the conventional approach would be a scientist or engineer with little or no public speaking experience who narrates a slide show and passes out student handouts. It is thought that in nearly all cases, the narration would be read verbatum from the script. It was further assumed that during the question and answer period, which follows each presentation, some additional information, not found in the script, may be interjected.

The audiovisual approach was assumed to involve the use of an audiovisual machine and workbook in the presence of a supervisor. His primary function would be to lead group discussions and answer questions. The ideal audience for this approach consists of no more than 15 persons. However, as noted earlier in the report, the program can be adapted to larger audiences by using 35 millimeter slides rather than the standard 16 millimeter film strip.

DEMONSTRATION

The demonstration and evaluation was conducted on a typical target audience consisting of inspectors and construction foremen.

Due to the coincidence of the demonstration and evaluation program with the active construction season, it was not possible to obtain enough time to demonstrate all of the presentations and evaluate all six audiovisual programs

against their conventional counterparts. Instead, it was decided to use only two presentations to compare the different approaches. These were the presentations on "Goal, Objectives and Principles of Erosion and Sediment Control" and on "Erosion and Sedimentation". A third presentation, entitled "Control of Runoff During Construction", was demonstrated to gather comments from the audience regarding preferences for the two approaches.

PROCEDURE

Government inspectors and contractor's foremen were invited to participate in the demonstration and evaluation program. The program was held at Hittman Associates in Columbia, Maryland on June 13, 1973. A total of 26 men arrived.

As each man arrived he was given a form, prepared by the Water Resources Administration, on which he could record profile information (see Appendix "F"). Each form was numbered consecutively from one through twenty-six. Following an introduction and statement of the purpose of the project, the men with odd numbered forms were asked to leave the room and go to another location where they were shown the audiovisual program. Those with even numbered forms were asked to stay in the first room and were then given a conventional presentation.

During the first period, both groups viewed the presentation on "Goal, Objectives and Principles of Erosion and Sediment Control". The group with odd numbers received the information via an audiovisual program and the group with even numbers received it via a conventional slide-illustrated presentation. In the second period the groups viewed the material on "Erosion and Sedimentation". Again, the odd numbered group received the audio-

visual version and the even numbered group received the conventional presentation.

Both groups were then given the same evaluation test (see Appendix "G"). This was a test containing 47 questions. Multiple choice, true or false, and completion of sentences were the test forms used. The possible score was 69.

Following the test, both groups had lunch and then they reversed their roles. That is, the odd numbered group received a conventional presentation and the even numbered group received an audiovisual program. They both were exposed to the same subject, namely "Control of Runoff During Construction." Both groups were then given a form on which to evaluate the two different methods of presentation (see Appendix "H").

TEST RESULTS

The odd numbered group of 13 received the audiovisual presentation and the even numbered group of 13 received the lecture. Thus, the odd numbered group was the experimental and the even numbered group was the control.

Table 1 shows the raw number of errors scored by each individual. The percentage of correct answers has also been calculated.

TABLE 1. EVALUATION TEST SCORES

Experimental (Audiovisual)

Subject	Test Errors	Percent Correct
1	23	66
3	5	93
5	8	88
7	5	93
9	3	96

11	8	88
13	5	93
15	6	91
17	9	72
19	2	97
21	11	84
23	8	88
25	6	91
	TOTAL =	1140

Total Errors = 99

Mean Errors = 7.7

Mean Percent correct answers = 88%

CONTROL (Conventional)

Subject	Test Errors	Percent Correct
2	9	72
4	11	84
6	17	75
8	2	97
10	12	82
12	9	72
14	6	91
16	5	93
18	4	94
20	18	74
22	4	94
24	21	69
26	18	74
	TOTAL =	1071

Total Errors = 136

Mean Errors = 10.5

Mean percent correct answers = 82%

PROFILE OF PARTICIPANTS

Table 2 shows two of the key characteristics taken from the profile forms completed by the participants. It has been completed to show if a specific participant was an inspector (an X opposite the participant number) and whether he had completed at least two years of college (an X opposite the participant number in the column headed College). Participants without an X were construction foremen or had not completed two years of college. All participants had graduated from high school.

TABLE 2. PROFILE OF PARTICIPANTS

Experimental (Audiovisual)

Subject	Inspector	College
1	X	
3	X	
5		
7	X	
9	X	
11	X	X
13		X
15		
17		
19		X
21	X	
23	X	X
25	X	

CONTROL (Conventional)

Subject	Inspector	College
2	X	
4	X	
6		X
8	X	X
10	X	
12	X	
14		X
16	X	X
18		
20		
22	X	
24	X	
26		

PREFERENCE OF PARTICIPANTS

Table 3 shows the subjects in each group who indicated a general preference for the audiovisual presentation. Those not marked with an X indicated a preference for the conventional presentation.

TABLE 3. ATTITUDE TOWARDS METHOD OF PRESENTATION

Experimental		Control	
Subject	Favorable to A/V	Subject	Favorable to A/V
1		2	X
3	X	4	X
5	X	6	
7	X	8	
9		10	
11	X	12	X
13	X	14	X
15	X	16	
17	X	18	X
19	X	20	
21	X	22	X
23	X	24	X
25	X	26	X
	Total = 11		Total = 8

STATISTICAL ANALYSES

Since the test population was rather small (thirteen in each of two groups) and only two conditions existed (an experimental group E instructed by means of audiovisual programs and a control group C instructed by means of a lecture), the applicable statistical techniques are the Mann-Whitney U test and the Kolmogarov-Smirnov two-sample test.

Null Hypothesis

H_o: There is no difference in the number of errors made in answering the evaluation questions given the two groups.

Alternative Hypothesis

H_1: The experimental group E will score fewer errors in answering the evaluation questions than will the control group C.

Kolmogarov-Smirnow Two-Sample Test

Test Scores (Percentage)

	95-100	90-95	85-90	80-85	75-80	70-75	65-70
$S_{13_1}(X)$-E	2/13	7/13	10/13	11/13	11/13	12/13	13/13
$S_{13_2}(X)$-C	1/13	5/13	5/13	7/13	8/13	12/13	13/13
$S_{13_1}(X)$ $-S_{13_2}(X)$	1/13	2/13	5/13	4/13	3/13	0	0

$K_D = 5.0$

The table of Critical Values of K_D shows that for N of 13, K_D should be 7 or more at the 0.05 level of probability. Thus a K_D of 5 is not significant at $\alpha = 0.05$.

Chi-Square Test

If we extend this with a chi-square approximation:

$$x^2 = 4D^2 (n_1 n_2 / n_1 + n_2)$$

$$= 4 (5/13)^2 13x13/13+13$$

$$= 100/169 \times 169/26$$

$$= .59 \times 65$$

$$= 3.84$$

df (degree of freedom) = 2

In the table for Critical Values of chi-square we find that $x^2 = 3.84$ is significant at 0.2 for 2 degrees of freedom.

The Mann-Whitney U Test

The following breakdown shows the scores arranged in rank order with the identity of each score indicated as experimental (E) or control (C).

97	97	96	94	94	93	93	93	93	91	91	91	88	88	88	72
E	C	E	C	C	E	E	E	C	E	E	C	E	E	E	E

72	72	84	84	82	75	74	74	69	66
C	C	E	C	C	C	C	C	C	E

$$U = 0+2+2+5+7+11+11+12$$

$$= 60$$

The critical value of U for a one-tailed test $\alpha = 0.05$ and an n_1 and n_2 of 13 is 51. Thus our results are not significant at the 0.01 level.

DISCUSSION

The experimental group taken as a whole did score better on the test than did the control group. The experimental group made a total of 99 errors as compared with a total of 136 errors made by the control group. That was a mean score of 88 percent for the experimental group and 82 percent for the control group.

From Table 2 we find that the experimental and control groups were equally divided with respect to employment and level of education. Both groups had eight inspectors and both had four individuals who had completed two years of college. This distribution was fortuitous considering that the group selection was made on a completely random basis.

Although the experimental group scored better than the control group, the statistical significance is only marginal. With such a small group of subjects who already have some professional experience in the subject area of the test, it is not surprising to find that there is not a highly significant difference between the test scores.

The evaluation of the presentation by the individuals in the two groups does present some significant information. Of the 13 subjects in the experimental group, 11 were favorable to the audiovisual presentation while only eight were favorable in the control group. This might be explained by the fact that the experimental group had more exposure to the audiovisual technique and had thus grown more accustomed to it. However, both groups clearly preferred the audiovisual presentation over the lecture.

Some of the statements expressing preference for the audiovisual program were:

"I think the audiovisual method of presentation is a 100 percent improvement over the old lecture method."; "This type of presentation was much more interesting"; "More lively than the average lecture--this is particularly important with technical material"; "Held attention better"; "Audiovisual program was far easier to follow"; "This was the most effective method of presenting and demonstrating new material I have ever seen."

Criticism of the audiovisual approach mainly concerned the large number of breaks in the program for questions and discussions. This may not have been made had the programs been presented to individuals in a one to one situation, with a rear screen in a well lighted room. Part of the problem with frequent breaks was that changes back and forth from a dark room to full light had to be made.

In summary, it may be said that the audiovisual presentation was certainly as effective as a conventional lecture and most individuals preferred it to the lecture.

SECTION VI

CERTIFICATION PLAN

GENERAL

A requirement of this demonstration program was to develop a plan for the certification of erosion and sediment control specialists in the State of Maryland.

The framework for this certification program was developed by Hittman Associates, working closely with the Maryland Water Resources Administration.

It was mutually decided that the primary thrust of the plan would be to certify the on-site erosion and sediment control specialists. The word "specialist" is intended to mean only construction foreman or supervisors. The majority of the governmental inspectors are not specialists in that they are also responsible for the inspection of other construction related functions and pollution sources. Of course, it is not felt that the erosion and sediment control inspector should be denied the opportunity to acquire the certification, only that its acquisition not be considered an essential requirement of his job. However, it is important that the governmental inspector be exposed to the program developed in this demonstration. It is felt that state and local agencies responsible for erosion and sediment control will readily and voluntarily utilize the program. Strong leadership by the state will be an important factor in this regard.

On the other hand, it is felt that many of the private construction contractors performing grading work will not quickly, nor fully utilize the states' program unless they are legally required to have a certified specialist

in charge of the implementation of erosion and sediment control plans on their construction sites. This requirement can be accomplished by an amendment to the existing Maryland Sediment Control Law and/or Regulations. This amendment would state to the effect that all contractors performing grading operations shall have an on-site certified erosion and sediment control specialist to supervise the implementation of the erosion and sediment control plans. Only those construction sites not requiring a sediment control plan or requiring a standard plan, as defined in the Maryland Sediment Control Rules and Regulations, would be exempt from this requirement.

IMPLEMENTATION

One integral part of a program to certify erosion and sediment control specialists would be the dissemination of the materials developed in this demonstration to the counties, constructors, and educational institutions to help personnel to become knowledgable erosion and sediment control specialists. This can best be accomplished by holding small seminars with a knowledgable person in charge of the presentations. State and local governmental agencies, soil and water conservation districts, educational institutions, and large contractor's would readily utilize the material for this use. When a group cannot be assembled, the individual viewing method could be employed. The audiovisual programs are well suited for this type of information dissemination.

In that it will take some time to certify these specialists, it is felt than an interim certification should be initially issued and a time limit set for full certification. It is recommended that an interim certification be required by July 1, 1974, at which time the amendment to the law and/or regulation would become effective, and that a full certification be required by July 1, 1976.

Interim Certification

The minimum requirements for interim certification should be three years grading or related construction experience, one year of which must be in a supervisory capacity which includes responsibility for the implementation of erosion and sediment control plans. No test would be required, but an application would have to be made to the Maryland Department of Natural Resources and approved by the board and an interim certificate issued to the applicant.

Full Certification

Full certification would require five years of grading or related construction experience, two years of which must be in a supervisory capacity which includes responsibility for implementing erosion and sediment control plans. Up to two of the three years of non-supervisory experience could be substituted by job-related, post-high school education.

The applicant would have to apply to the state for the certification and pass a written or oral test on the subject of erosion and sediment control. The tests would be geared to the training program developed in this demonstration and would be administered two or more times a year, depending upon demand. The applicant would be allowed to take an oral exam if he failed the written test at least twice and had taken the prescribed state training program consisting of the audiovisual presentations. No limit would be set on the number of times the applicant could take the test.

Organization

The program would be administered by a Maryland Board of Erosion and Sediment Control Specialist, composed of five to seven representative members appointed by the Secretary of the Maryland Department of Natural

Resources. This body would be responsible for promulgating and enforcing rules and regulations, developing and administering the testing program, awarding "certificates", and collecting certification fees. Total or partial funding would come from an application fee charged for the initial certification and a renewal fee collected every two years.

The board would have to be assembled no later than January 1, 1974. To achieve interim certification by July 1, 1974, an application form would be required prior to January 1, 1974. This could be developed by the Department of Water Resources and patterned after the application forms used by the Maryland State Board of Well Drillers, the Maryland Board of Certification for Industrial Wastewater Works Superintendents, and other state professional boards. The experience of these same boards would also be very helpful in setting up the administrative structure of the program and in preparing other essential documents.

SECTION VII

REFERENCES

1. Guidelines for Erosion and Sediment Control Planning and Implementation, Water Resources Administration, State of Maryland and Hittman Associates, Inc., for EPA, EPA Report No. EPA-RZ-72-015, August 1972.

2. U. S. Department of Agriculture, Soil Conservation Service, College Park, Maryland, Standards and Specifications for Soil Erosion and Sediment Control in Urbanizing Areas, 1969.

SECTION VIII

APPENDICES

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APPENDIX A

SAMPLE CONVENTIONAL PRESENTATION AND VISUALS

PROGRAMMED DEMONSTRATION FOR EROSION AND SEDIMENT CONTROL SPECIALISTS

PRESENTATION NO. 7

CONTROL OF SEDIMENT GENERATED ON CONSTRUCTION SITES

Project No. S800854 (15030 FMZ)

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LESSON NO. 7

CONTENT OUTLINE

I. INTRODUCTION

II. VEGETATIVE PRACTICES

- A. Natural Vegetative Buffers
- B. Woodland Areas
- C. Graded Vegetative Buffers
- D. Contour Strips
- E. Sod Inlet Filters

III. STRUCTURAL

- A. Dikes and Filters
  - 1. Gravel Inlet Filter
  - 2. Interceptor Dike and Inlet Filter
- B. Sediment Traps
  - 1. Sandbag Trap
  - 2. Straw Bale Trap
  - 3. Straw Bale Barrier
  - 4. Excavated Trap
- C. Sediment Basin
  - 1. Dry Basin
  - 2. Wet Basin or Pond
  - 3. Maintenance

The subject of this presentation is "Control of Sediment Generated on Construction Sites." By this, we mean the trapping of sediment on the construction site as near its point of origin as possible. In an indirect sense, you may think of erosion control practices as doing this, in that they are designed to reduce soil erosion which, as you are aware, is the source of sediment. However, a point to keep in mind is that we can only expect reasonable erosion control. Thus, even with the best plan, some erosion must be anticipated and, therefore, some sediment will be generated. This presentation is directed at the control of this sediment.

In an erosion and sediment control plan, we establish two separate lines of defense against sediment damage. The first defense is the erosion control which reduces the amount of sediment that will be generated and the second is the sediment control which prevents much of the sediment from uncontrollable soil erosion from leaving the construction area. To be fully effective in preventing costly sediment damage and, at the same time, to prevent ugly erosion and minimize the loss of precious topsoils, both defenses must be used.

How do we keep this sediment from damaging the environment? This is accomplished by using vegetative and structural practices, some very simple and others more complicated, that trap most of the sediment before it leaves the construction site. The purpose of this presentation is to show you some of these practices and to point out pertinent factors regarding their construction, use, and maintenance.

Sediment control practices are designed to slow the flow of water either by spreading, ponding, or filtering. By so doing, the ability of the water to transport sediment is reduced and sediment settles out of suspension. The amount of sediment removed from the runoff is dependent upon three factors: First, the speed that the water flows through the trap; secondly, the length of time the water is detained; and lastly, the size and weight of the sediment particle carried into the trap.

With regard to the first two factors, the slower the flow of water and the longer it is detained, the greater will be the quantity of sediment removed.

The size and weight of the sediment particles determine the speed at which they settle out of suspension. The larger and heavier a particle, the faster it settles out. The efficiency of sediment trapping is expressed as the percent of sediment removed from the runoff.

Now that we have reviewed the basic principles governing the function and efficiency of sediment traps, let's look at some of the practices used to trap sediment.

SLIDE NO. 1 - CAPTION: VEGETATIVE PRACTICES
STRUCTURAL PRACTICES

There are two types of sediment control practices – vegetative and structural. Let's look at the vegetative practices first.

SLIDE NO. 2 - CAPTION: VEGETATIVE PRACTICES
1. NATURAL VEGETATIVE BUFFERS
2. WOODLAND AREAS
3. GRADED VEGETATIVE BUFFERS
4. CONTOUR STRIPS
5. SOD INLET FILTERS

These include natural vegetative buffers, graded vegetative buffers, contour strips, woodland areas, and sod inlet filters.

SLIDE NO. 3 - NATURAL VEGETATIVE BUFFER

A natural vegetative buffer is a strip of natural vegetation preserved along the downhill perimeter of the graded area to slow and filter overland flow. Keep in mind that this is one of the more effective and economical methods of removing sediment from overland flow. The preservation of such a buffer is most essential along waterways.

The need for preserving natural buffer areas must be recognized at the planning and design stage of development and these areas must be prominently displayed on the construction plans as off-limits to all construction activity.

SLIDE NO. 4 - UTILITY CONSTRUCTION ALONG A STREAM

Except for essential roadway crossings, no construction must be allowed within the buffer area. Good planning by the engineer and careful grading by the contractor could have preserved a protective buffer along this stream and prevented serious sediment pollution. Instead, all of the vegetation was destroyed along the stream bank and the spoil from the utility excavation was pushed into the stream.

SLIDE NO. 5 - STOCKPILED SOIL ON A FLOODPLAIN

This is another example of poor sediment control planning. The contractor was allowed to stockpile soil on a floodplain. Not only is the chance of sediment pollution from overland flow greatly increased by this action, but the prospects of damaging flooding coupled with very severe erosion is greatly enhanced.

SLIDE NO. 6 - NATURAL VEGETATIVE BUFFER DAMAGED BY CONSTRUCTION TRAFFIC

This is still another example of what not to do to a vegetated buffer area whether it be natural or planted. Vegetation damaged by uncontrolled construction traffic cannot efficiently filter overland flow. Keep all traffic out of the area and maintain a vigorous cover of vegetation.

SLIDE NO. 7 - VEGETATIVE BUFFER BELOW A FILL

Because of its low, dense growth and other factors, grass is the best vegetative filter material. Thick, low-growing legumes such as white or red clover are also effective filters.

Even during the dormant winter months, the mat provided by the dead foliage still slows the flow of runoff and traps sediment before it reaches the drainage system.

SLIDE NO. 8 - WOODLAND LITTER

The thick mat of litter covering natural woodland areas also provides a high degree of filtering action as well as aiding in the absorption of runoff.

SLIDE NO. 9 - SEDIMENT DEPOSITION IN A WOODLAND AREA

Considerable care must be exercised, however, in utilizing woodland areas for trapping sediment. The deposition of a couple of inches or more of sediment around a tree may reduce the oxygen supply to the shallow feeder roots to such an extent that the tree will die. It is best to use such areas only for the filtering of overland flow and not for filtering concentrated flow containing heavy concentrations of sediment.

SLIDE NO. 10 - TREES DESTROYED BY SEDIMENT

Remember, it is a simple matter to reestablish a cover of grass destroyed by sedimentation, but not so a stand of trees.

SLIDE NO. 11 - CONSTRUCTED VEGETATIVE BUFFER

When it is not possible to preserve a natural vegetative buffer, one can be constructed. We then refer to it as a constructed vegetative buffer. Planning for the construction must be done during early design stages.

The flatter and the longer the buffer area can be made, the more sediment it will retain. A positive grade of two percent will provide controlled spreading and runoff.

SLIDE NO. 12 - CONSTRUCTED VEGETATIVE BUFFER

Timely establishment of vegetation on the buffer is a must if it is to be fully effective.

SLIDE NO. 13 - SEDIMENT-LADEN RUNOFF FLOWING OVER A GRASSED AREA

A thick stand of grass slows the overland flow and filters out sediment. In addition to filtering the flow, the vegetation allows more water to be absorbed by the soil and thus decreases the ability of the runoff to transport sediment.

SLIDE NO. 14 - SEDIMENT TRAPPED BY GRASS BELOW A GRADED AREA

Note the effectiveness of both the flattened slope and the grass in trapping sediment from the overland flow coming off the graded area.

SLIDE NO. 15 - SODDED DRAINAGEWAY ADJACENT TO A GRADED AREA

Staged grading is a means of providing a vegetative buffer along a drainageway. In this case, the drainageway was constructed and stabilized with vegetation prior to the beginning of roadway construction.

SLIDE NO. 16 - GRASSED EMBANKMENT ABOVE A DENUDED BUFFER STRIP AND CHANNEL CHANGE

This roadway construction site reflects very poor planning on the part of the engineer. The channel change and buffer strip were constructed before the embankment in the foreground. The buffer strip was not vegetated prior to the embankment construction. In fact, the embankment was vegetated before the buffer area.

SLIDE NO. 17 - SEDIMENT WASHED INTO WATERWAY

By failing to promptly vegetate the buffer strip, thousands of tons of sediment were washed into the lower-lying waterway.

SLIDE NO. 18 - SEDIMENT-CLOGGED CHANNEL AND RESULTING BANK EROSION

The heavy deposition of sediment in the channel forced the stream to meander and erode the bank. Additional sediment was introduced into the drainage system as a result.

SLIDE NO. 19 - VEGETATIVE CONTOUR STRIPS OR BUFFERS

Here is a sediment trapping method that has been borrowed from the farmer. It is used to break the flow of runoff on long hillsides and is called contour stripping. It involves the establishment of strips of vegetation, usually grass sod, along the ground contour at regular intervals up the slope. These buffer strips slow the flow and reduce the amount of runoff, thereby reducing erosion, while at the same time trapping much of the sediment generated from unpreventable erosion.

SLIDE NO. 20 - VEGETATIVE "RIGHT-OF-WAY" BUFFER

The use of a vegetative buffer near the base of a highway slope serves the same function as the contour strips.

SLIDE NO. 21 - SOD INLET FILTER

The sod inlet filter is another vegetative practice used to control sediment. It consists of pads of sod placed around the storm drain inlet and works on the same principle as the vegetative buffer areas previously discussed. The grass slows the flow of water into the inlet and filters out appreciable amounts of sediment. The size of the sodded area is varied depending upon the amount of runoff expected at the inlet. This practice should only be used to handle light concentrations of sediment. It can best be used after final grading is complete and during the establishment of a vegetative cover.

SLIDE NO. 22 - CONCENTRATED RUNOFF CARRYING SEDIMENT

Once the flow becomes concentrated, as it does in ditches and other drainageways, the trapping of sediment becomes much more difficult and expensive.

SLIDE NO. 23 - STORM DRAIN CLOGGED WITH SEDIMENT

Although it is not feasible to trap all of the generated sediment, we can certainly retain enough of it to prevent disastrous damage such as this. Remember, the amount of sediment that escapes our control practices must be kept to a level that the waterway can effectively handle.

To prevent this type of damage, structural practices are also required to control the sediment.

SLIDE NO. 24 - CAPTION: STRUCTURAL PRACTICES

1. DIKES AND FILTERS
2. SEDIMENT TRAPS
3. SEDIMENT BASINS

These include dikes and filters, sediment traps, and sediment basins.

On urban construction sites and on major highway projects where storm drains are used, the prevention of sediment damage to the drainage system becomes a particularly important task.

SLIDE NO. 25 - UNPROTECTED STORM DRAIN INLET

To provide for drainage during construction, storm drains must be installed well ahead of final grading. As a result, sediment generated on the graded areas is given unrestricted access to the drainage system downstream of the construction site.

SLIDE NO. 26 - SEDIMENT IN STREAM CHANNEL BELOW STORM DRAIN OUTFALL

Failure to take adequate measures to trap much of the sediment before it reaches the storm drainage system will lead to extremely costly damage to the storm drain as well as to the waterways lying below the outfall.

SLIDE NO. 27 - SEDIMENT CLOGGING STREAM IN WOODLAND AREA

This is a common example of what happens when sediment is given unrestricted access to the storm drainage system. The cost to remove the sediment from this stream will run to several thousands of dollars and, in many instances, will be borne by the taxpayer. Consider also the damage to the trees and other vegetation as well as the total destruction of the stream ecology which cannot be measured in dollars and cents.

SLIDE NO. 28 - GRAVEL INLET FILTER

In this case, coarse gravel was piled around an inlet to form a barrier that will both temporarily impound runoff and act as a filter. This structure is commonly referred to as a gravel inlet filter.

Crushed stone is also used to construct this type of filter barrier. In addition to providing a certain amount of filtering action, gravel or crushed stone is highly resistant to erosion should overtopping occur during heavy storms.

SLIDE NO. 29 - GRAVEL INLET FILTER ALONG PROPOSED ROADWAY GUTTER

The configuration of the gravel inlet filter will depend upon the type of inlet being protected. This, for example, is a standard inlet used along concrete roadway gutters in urban areas. In this case, the stone is placed directly in front of the inlet opening. To keep the stone from falling into

SLIDE NO. 30 - DRAWING OF GRAVEL INLET FILTER ALONG ROADWAY GUTTER

the storm drain, concrete blocks are inserted in the opening. A board placed across the opening with a space of at least one-half inch at the top and bottom will also work.

SLIDE NO. 31 - GRAVEL INLET FILTER PONDING RUNOFF

As mentioned before, an inlet filter is designed to temporarily pond runoff as well as to act as a filter. Ponding slows the flow of runoff and allows much of the sediment to settle out of the water.

SLIDE NO. 32 - GRAVEL INLET FILTER REQUIRING MAINTENANCE

Prompt maintenance is a very essential requirement for the successful operation of a sediment trap. As you are aware, in order for this inlet filter to be fully effective, it must be able to temporarily pond and filter the runoff. Completely clogged with sediment, it can do neither.

SLIDE NO. 33 - BREACHED INTERCEPTOR DIKE

When clogging occurs, the sediment is simply carried over the stone and into the storm drain or, as in this case, the interceptor dike which directs the water into the inlet was washed out, allowing the sediment and runoff to continue down the right-of-way and onto the lower-lying highway. From there, it quickly found its way into the storm drainage system and eventually into the natural drainage courses.

To prevent this from happening, the trap must be inspected after each storm and cleaned prior to becoming ineffective – not after. Furthermore, the sediment that is removed must not be disposed of back on the graded right-of-way, but instead in a stabilized area away from the grading where the sediment cannot be reintroduced into the drainage system. A solution that would allow it to be disposed on the site would be to bury it in a fill. Care must be exercised, however, to see that an adverse foundation condition is not created.

SLIDE NO. 34 - SOIL INTERCEPTOR DIKE AND GRAVEL INLET FILTERS

On roadway rights-of-way, an interceptor dike is used to intercept runoff coming down the graded roadway and divert it into storm drain inlets protected by gravel filters. By combining the two structures, the trapping efficiency is greatly increased. As you can see, water is ponded along the entire length of the interceptor dike.

As well as aiding in the trapping of sediment, the interceptor dike, as you may recall from a previous lesson, also helps control erosion by diverting runoff away from the graded surface.

SLIDE NO. 35 - SANDBAG SEDIMENT TRAP

Any structure that interrupts the flow of runoff that is transporting the sediment will trap sediment. The amount of sediment that it will collect or its efficiency will depend on how long it is able to detain the flow.

This is a sandbag sediment trap constructed across a ditch upstream of a storm drain inlet. This practice is a quick and economical method of temporarily disrupting flow and trapping the coarser sediment particles. By positioning these barriers at regular intervals along the ditch, a high degree of trapping efficiency can be achieved.

The sandbags are filled with soil or stone and are stacked in an interlocking fashion to provide additional strength for resisting the force of the flowing water.

SLIDE NO. 36 - CROSS SECTIONAL DRAWING OF TYPICAL SANDBAG STRUCTURE

A major cause of failure for many of the temporary sediment traps is piping. This is the flow of water beneath the structure rather than through or over the top of the barrier. By setting the sandbags in a trench excavated a minimum of six inches in depth and by firmly tamping soil along the uphill face of the bags, the chance of piping failure is greatly reduced.

SLIDE NO. 37 - STRAW BALE SEDIMENT TRAP

Straw or hay bales are also used to construct small temporary barriers to trap sediment. Straw bale traps are a fast and economical means of providing a temporary sediment trap. Although they function well when properly installed, straw bale traps do deteriorate rather rapidly. One means of prolonging the service life of the trap is by using wire-tied bales rather than those tied with twine.

When only twine-tied bales are available, the same effect can be achieved by securely wrapping them with sturdy wire at the location of the twine.

In constructing the trap, the bales are laid on their sides and staked in place. At least two wooden or metal stakes are driven through each bale and into the ground.

SLIDE NO. 38 - CROSS SECTIONAL DRAWING OF A STRAW BALE TRAP

As in the case of sandbag traps, piping beneath the structure can render the trap ineffective. To prevent this, the straw bales are also set in a trench excavated to a depth of at least six inches and excavated soil is compacted along the upstream face.

SLIDE NO. 39 - SEDIMENT COLLECTED BEHIND A STRAW BALE TRAP

Like all other sediment traps, straw bale and sandbag traps also require periodic inspection and very prompt maintenance if they are to continuously function. Again, sediment removal does not mean shoveling the sediment off to one side where the next storm will send it directly back into the drainage system. Instead, properly dispose of it in a noncritical fill or some other safe area.

SLIDE NO. 40 - STRAW BALE PERIMETER BARRIER

Before departing from straw bales, it is important to point out another of their applications for trapping sediment. This is in providing a sediment barrier along the downhill perimeters of small graded sites where area restrictions or other factors prevent the use of other practices.

In this case, the bales were placed along the base of a short graded slope to prevent sediment from being washed out onto the roadway. The bales must be placed in the same manner as prescribed for those used to construct small traps.

SLIDE NO. 41 - BARRIER FAILURE

Close inspection is required to insure that the barrier is retaining the sediment. Where failures occur, corrective action must be taken immediately.

SLIDE NO. 42 - EXCAVATED SEDIMENT TRAP IN A ROADWAY DITCH

Another means of trapping sediment before it enters the storm drainage system is to excavate a pit on the upstream side of the inlet. As in the case of all of the other traps, its function is to temporarily detain the runoff and thereby allow some of the sediment to settle out. The buildup of sediment at the upstream end of this pit attests to the effectiveness of this type of trap.

SLIDE NO. 43 - LARGE EXCAVATED TRAP AROUND A STORM DRAIN INLET

Here is an example of a large excavated sediment trap used on a school construction site. It is an excellent example of very good planning on the part of the engineer. This trap cost very little to construct in that it made use of existing structures. The only additional cost incurred was in excavating the pit. Another plus factor was that the pit was made big enough to accommodate all of the sediment coming off the graded area without requiring cleaning. Thus, once the sediment-yielding area is stabilized, the the pit area can simply be filled in the rest of the way with soil and covered with sod.

Also, note the well-constructed diversion dikes leading up to the sediment trap. Their purpose is to prevent sediment from leaving the construction site and to divert it, instead, into the trap.

SLIDE NO. 44 - DRY SEDIMENT BASIN

Sediment basins are the most effective structures for trapping sediment. They are used on large construction sites where heavy concentrations of both runoff and sediment are anticipated.

Sediment basins are formed by constructing an earthen dam across a drainageway, thus causing the runoff to pond during storms. There are two basic types of sediment basin – the dry basin and the wet basin. The basin shown on the screen is an example of a dry sediment basin. It is designed to only temporarily impound runoff during rainfalls.

SLIDE NO. 45 - STANDARD GALVANIZED METAL RISER PIPE

The structure is drained by a standard metal riser pipe open at the top to handle runoff at a controlled rate during storms. Perforations are provided along the pipe to prevent the structure from permanently ponding water. The odd-looking device at the top of the riser pipe is an antivortex plate and trash rack. Its purpose is to increase the intake capacity of the pipe and at the same time to minimize the possibility of trash blockage.

SLIDE NO. 46 - RISER PIPE CONNECTED TO HORIZONTAL BARREL

The riser pipe is connected to a metal horizontal drain pipe, called a barrel, that conducts the water through the earthen dam.

SLIDE NO. 47 - EMERGENCY SPILLWAY

An emergency spillway is provided in the event the runoff exceeds the design capacity of the pipe structures.

A formal design by an engineer or other similarly qualified individual is required to properly size the basin and all of its components to the drainage area emptying into the basin. Another reason for this requirement is safety. The failure of larger impoundments could lead to costly property damage and even loss of life.

Close control must also be provided to insure that proper construction practices are employed. Only suitable soils must be used to construct the dam and a high degree of compaction must be achieved.

SLIDE NO. 48 - DRY SEDIMENT BASIN

Proper vertical positioning of riser pipe as well as good bonding between the structure and the barrel are also very essential to the proper performance of the structure as well as safety.

SLIDE NO. 49 - PIPING FAILURE IN A DRY SEDIMENT BASIN

Piping failures, that is, flow along the outside of the drain pipe, are all too common in temporary dry sediment basins. A cavity at the base of the riser pipe is the tell-tale evidence of such failure. This problem is the result of poor bonding between the drain pipe and the soil forming the dam.

SLIDE NO. 50 - FAILED DRY SEDIMENT BASIN

If not corrected, piping will, in time, lead to the total failure of the dam.

Before constructing a sediment basin, it is advisable to consult the state and local regulations governing their design and construction. One can obtain these regulations from the local soil and water conservation district, county or city public works department, or the state pollution control agency.

SLIDE NO. 51 - SEDIMENT BASIN REQUIRING CLEANING

Another factor that is too often ignored is cleaning. Many sediment control structures are well-conceived, designed, and constructed, but fail to perform their required function because of the absence of follow-up maintenance. In this case, the basin is completely filled with sediment. The trapping efficiency has dropped to zero and incoming sediment has unrestricted access into the riser pipe and out into the lower-lying drainage system.

To prevent this from happening, it is essential that the erosion and sediment plan incorporate methods for determining when a basin has filled to its capacity and strong language as to the immediate requirement for cleanout once this occurs.

SLIDE NO. 52 - MARKED RISER PIPE

To assist the foreman and inspector in determining when cleaning is required, a marking should be made on the riser pipe to indicate the level that sediment can build up to before cleaning becomes essential.

SLIDE NO. 53 - CLEANING OF A DRY SEDIMENT BASIN

Dry sediment basins are usually cleaned with a backhoe or a dragline. Smaller basins having firm foundations are sometimes cleaned with front-end loaders.

SLIDE NO. 54 - RISER PIPE EXTENDING ABOVE DAM

Earlier, we mentioned the need to insure that the riser is positioned properly. In inspecting construction, a point to also check for is that the top of the pipe is at least one foot below the crest of the dam. This riser obviously does not comply. When an emergency spillway is required, the distance between the top of the dam and the crest of the emergency spillway must also be at least one foot. The construction specifications for the basin must specify this required freeboard.

SLIDE NO. 55 - BREACHED SEDIMENT BASIN

Failure to adhere to these specifications is likely to result in overtopping during heavy storms and breaching of the dam.

SLIDE NO. 56 - WET SEDIMENT BASIN

Dry sediment basins are constructed on drainageways that only flow during storms. Often, it also becomes necessary to dam permanent streams in order to trap sediment. When this becomes necessary, a wet sediment basin is constructed. In other words, a pond is created.

On large residential developments, recreational impoundments also function as sediment traps. After the watershed is fully developed, the pond is cleaned and stocked with fish.

Wet sediment basins, or sediment ponds as they are also called, require a formal design and strict construction control for safety reasons.

SLIDE NO. 57 - DRAGLINE CLEANING OF A SEDIMENT POND

Cleaning of a sediment pond is a costly operation requiring heavy equipment, in this case a dragline, and an elaborate scheme to dispose of the excavated sediment in a manner that will prevent it from being reintroduced into the drainage system.

SLIDE NO. 58 - DREDGING OPERATION

On larger sediment ponds, it is necessary to use portable dredges to clean the sediment out of the pond.

SLIDE NO. 59 - DREDGE SPOIL DISPOSAL

The dredge spoil is pumped directly from the dredge to the disposal area. The disposal area in this case is a dry basin. Upon filling, the basin area will be graded and, in time, will be developed into a recreational park.

SLIDE NO. 60 - CAPTION: REVIEW OF SEDIMENT CONTROL PRACTICES

Before going to the question and answer period, let's take a quick look at all of the practices covered in the presentation.

SLIDE NO. 61 - REPEAT OF SLIDE NO. 3

These included natural vegetative buffer areas . . . .

SLIDE NO. 62 - REPEAT OF SLIDE NO. 12

constructed vegetative buffers .....

SLIDE NO. 63 - REPEAT OF SLIDE NO. 8

natural woodland areas . . . . .

SLIDE NO. 64 - REPEAT OF SLIDE NO. 19

vegetative contour strips or buffers. . . . .

SLIDE NO. 65 - REPEAT OF SLIDE NO. 21

sod inlet filter . . . .

SLIDE NO. 66 - REPEAT OF SLIDE NO. 29

gravel inlet filter . . . . .

SLIDE NO. 67 - REPEAT OF SLIDE NO. 34

interceptor dike . . . . .

SLIDE NO. 68 - REPEAT OF SLIDE NO. 35

sandbag trap . . . . .

SLIDE NO. 69 - REPEAT OF SLIDE NO. 37

straw bale trap . . . . .

SLIDE NO. 70 - REPEAT OF SLIDE NO. 40

straw bale barrier . . . . .

SLIDE NO. 71 - REPEAT OF SLIDE NO. 43

excavated trap . . . . .

SLIDE NO. 72 - REPEAT OF SLIDE NO. 44

dry sediment basin. . . . .

SLIDE NO. 73 - REPEAT OF SLIDE NO. 56

and the wet sediment basin or sediment pond.

This concludes the presentation on controlling erosion during construction.

NOTE: TURN LIGHTS ON

Are there any questions or comments on the sediment control practices covered in this presentation?

VISUALS FOR PRESENTATION NO. 7

SLIDE NO. 1

SLIDE NO. 2

SLIDE NO. 3

SLIDE NO. 4

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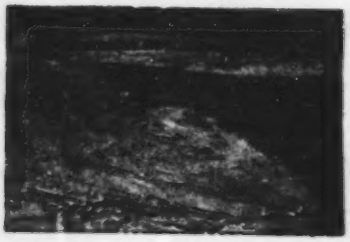

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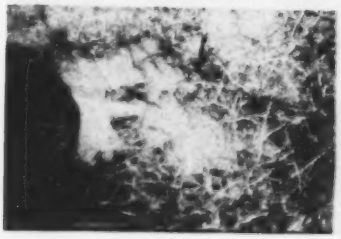

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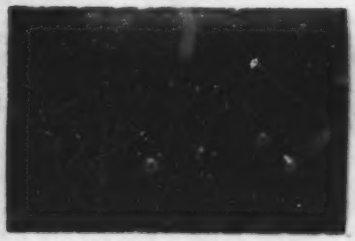

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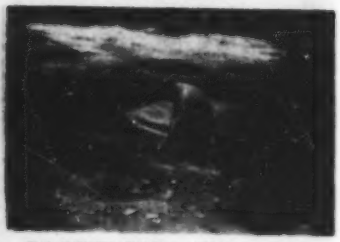

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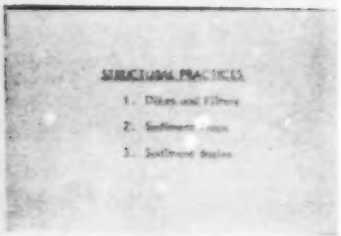

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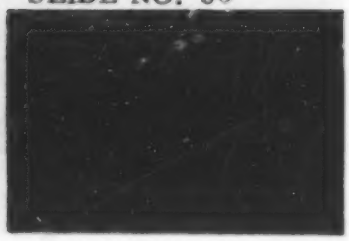

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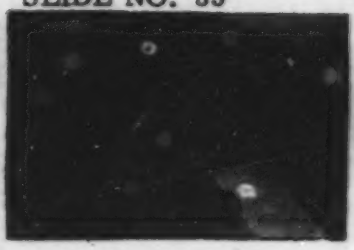

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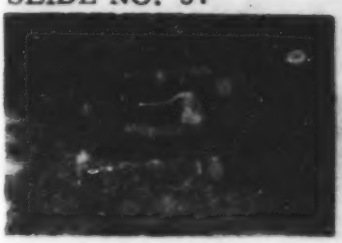

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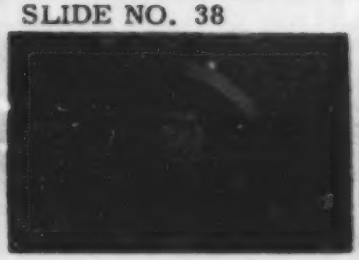

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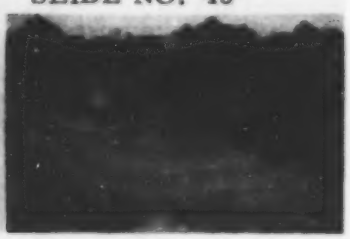

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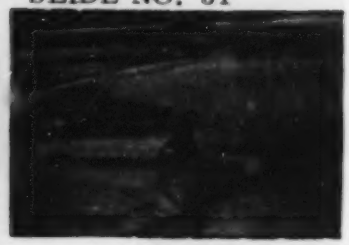

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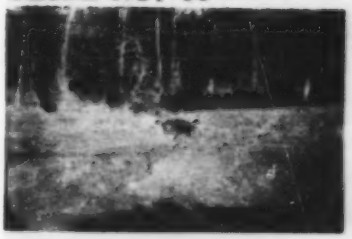

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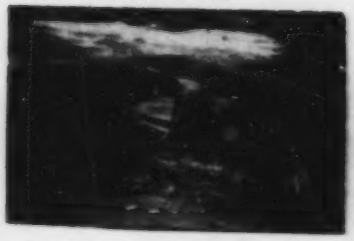

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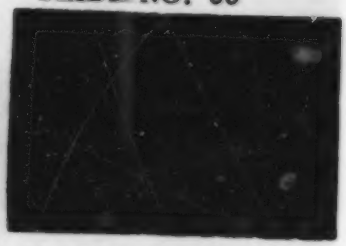

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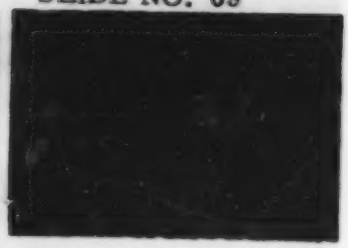

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SLIDE NO. 73

APPENDIX B

SAMPLE FOR A CONVENTIONAL PRESENTATION

PRESENTATION NO. 7

CONTROL OF SEDIMENT

GENERATED ON CONSTRUCTION SITES

HANDOUT

ACKNOWLEDGEMENT

Acknowledgement is hereby made that this material was prepared under the assistance of a jointly sponsored Grant program by the U.S. Environmental Protection Agency and the State of Maryland.

INTRODUCTION

By the "Control of Sediment Generated on Construction Sites," we mean the trapping of sediment on the construction site as near its point of origin as possible. In an indirect sense, one might think of erosion control practices as doing this, in that they are designed to reduce soil erosion which is the source of sediment. However, a point to keep in mind is that one can only expect reasonable erosion control. Thus, even with the best plan, some erosion must be anticipated and therefore some sediment will be generated.

In an erosion and sediment control plan, we establish two separate lines of defense against sediment damage. The first defense is the erosion control which reduces the amount of sediment that will be generated and the second is the sediment control which prevents much of the sediment from uncontrollable soil erosion from leaving the construction area. To be fully effective in preventing costly sediment damage and, at the same time, to prevent ugly erosion and minimize the loss of precious topsoils, both defenses must be used.

Sediment control actually begins during the planning and design phases of construction, starting with layout or alignment studies and culminating with the preparation of an erosion and sediment control plan. However, in this lesson, we will deal only with sediment control during construction. This involves the use of both vegetative and structural practices, some very simple and others more complicated, to trap most of the sediment before it leaves the construction site.

Sediment control practices are designed to slow the flow of water either by spreading, ponding, or filtering. By so doing, the ability of the water to transport sediment is reduced and sediment settles out of suspension. The amount of sediment removed from the runoff is dependent upon three factors: First, the speed that the water flows through the trap; secondly, the length of time the water is detained; and last, the the size and weight of the sediment particle carried into the trap.

There are two types of sediment practices – vegetative and structural.

VEGETATIVE PRACTICES

The vegetative practices include:

(1) Natural vegetative buffers

(2) Woodland areas

(3) Graded vegetative buffers

(4) Contour strips

(5) Sod inlet filters

Natural Vegetative Buffer

A natural vegetative buffer is a strip of natural vegetation preserved along the downhill perimeter of the graded area to slow and filter overland flow. This is one of the more effective and economical methods of removing sediment from overland flow. The preservation of such a buffer is most essential along waterways.

The need for preserving natural buffer areas must be recognized at the planning and design stage of development and these areas must be prominently displayed on the construction plans as off-limits to all construction activity. Except for essential roadway crossings, no construction must be allowed within the buffer area. The contractor must not be allowed to stockpile soil on a floodplain. Not only is the chance of sediment pollution from overland flow greatly increased by this action, but the prospects of damaging flooding coupled with very severe erosion is greatly enhanced.

All construction traffic must also be kept off the buffer. A dense healthy stand of vegetation must be maintained in order for the buffer to effectively filter runoff.

Because of its low, dense growth and other factors, grass is the best vegetative filter material. Thick, low-growing legumes such as white or red clover are also effective filters. Even during the dormant winter months, the mat provided by the dead foliage still slows the flow of runoff and traps sediment before it reaches the drainage system.

Woodland Areas

The thick mat of litter covering natural woodland areas also provides a high degree of filter action as well as aiding in the absorption

of runoff. Considerable care must be exercised, however, in utilizing woodland areas for trapping sediment. The deposition of several inches or more of sediment around a tree may reduce the oxygen supply to the shallow feeder roots to such an extent that the tree will die. It is best to use such areas only for the filtering of overland flow and not for filtering concentrated flow containing heavy concentrations of sediment. It is a simple matter to reestablish a cover of grass destroyed by sedimentation, but not so a stand of trees.

Graded Vegetative Buffer

When it is not possible to preserve a natural vegetative buffer, one can be constructed. It is then referred to as a graded vegetative buffer. Planning for the construction must be done during early design stages. The flatter and the longer the buffer area can be made, the more sediment it will retain. A positive grade of two percent will provide controlled spreading and runoff.

Timely establishment of vegetation on the buffer is also a must if the buffer is to be fully effective. A thick stand of grass slows the overland flow and filters out sediment. In addition to filtering the flow, the vegetation allows more water to be absorbed by the soil and thus decreases the ability of the runoff to transport sediment.

When grading must be performed along a waterway, stage the work so that grading and vegetative stabilization are completed along the side of the waterway first.

Vegetative Contour Strips

The use of vegetative contour strips is a practice borrowed from the farmer. It is used to break the flow of runoff on long hillsides. It involves the establishment of strips of vegetation, usually grass sod, along the ground contour at regular intervals up the slope. These buffer strips slow the flow and reduce the amount of runoff, thereby reducing erosion, while at the same time trapping much of the sediment generated from unpreventable erosion.

Sod Inlet Filter

The sod inlet filter is another vegetative practice used to control sediment. It consists of pads of sod placed around the storm drain inlet and works on the same principle as the vegetative buffer areas previously discussed. The grass slows the flow of water into the inlet and filters out appreciable amounts of sediment. The size of the sodded area is varied depending upon the amount of runoff expected at the inlet. This practice should only be used to handle light concentrations of sediment. It can best be used after final grading is complete and during the establishment of a vegetative cover.

STRUCTURAL PRACTICES

Structural practices include:

(1) Dikes and filters

(2) Sediment traps

(3) Sediment basins

On urban construction sites and on major highway projects where storm drains are used, the prevention of sediment damage to the drainage system becomes a particularly important task. To provide for drainage during construction, storm drains must be installed well ahead of final grading. As a result, sediment generated on the graded areas is given unrestricted access to the drainage system downstream of the construction site. Failure to take adequate measures to trap much of the sediment before it reaches the storm drainage system will lead to extremely costly damage to the storm drain as well as to the waterways lying below the outfall. The cost to remove the sediment from a stream can run to several thousands of dollars and, in many instances, will be borne by the taxpayer. Consider also the damage to the trees and other vegetation as well as the total destruction of the stream ecology which cannot be measured in dollars and cents.

Gravel Inlet Filter

In constructing a gravel inlet filter, coarse gravel or crushed stone is piled around an inlet to form a barrier that will both temporarily impound runoff and act as a filter. In addition to providing a certain amount of filtering action, gravel or crushed stone is highly resistant to erosion should overtopping occur during heavy storms.

The configuration of the gravel inlet filter will depend upon the type of inlet being protected. In the case of a standard curb inlet, the stone is placed directly in front of the inlet opening. To keep the stone from falling into the storm drain, concrete blocks are inserted into the opening. A board placed across the opening with a space of at least one-half inch at the top and bottom will also work.

Prompt maintenance is a very essential requirement for the successful operation of any sediment control structure. In order for an inlet filter to be fully effective, it must be able to temporarily pond and filter the runoff. Completely clogged with sediment, it can do neither. When clogging occurs, the sediment is simply carried over the stone and into the storm drain. To prevent this from happening, the trap must be inspected after each storm and cleaned prior to becoming ineffective — not after. Furthermore, the sediment that is removed must not be disposed of back on the graded right-of-way, but instead in a stabilized

area away from the grading where the sediment cannot be reintroduced into the drainage system.

On roadway rights-of-way, an interceptor dike is often used to intercept runoff coming down the graded roadway and divert it into storm drain inlets protected by gravel filters. As well as aiding in the trapping of sediment, the interceptor dike also helps control erosion by diverting runoff away from the graded surface.

Sandbag Sediment Trap

A quick and economical method of temporarily disrupting flow and trapping the coarser sediment particles is a sandbag sediment trap constructed across a ditch upstream of a storm drain inlet. By positioning these barriers at regular intervals along the ditch, a high degree of trapping efficiency can be achieved. The sandbags are filled with soil or stone and are stacked in an interlocking fashion to provide additional strength for resisting the force of the flowing water.

A major cause of failure for many of the temporary sediment traps is piping. This is the flow of water beneath the structure rather than through or over the top of the barrier. By setting the sandbags in a trench excavated a minimum of six inches in depth and by firmly tamping soil along the uphill face of the bags, the chance of piping failure is greatly reduced.

Straw Bale Sediment Trap

Straw or hay bales are also used to construct small temporary barriers to trap sediment. Straw bale traps are a fast and economical means of providing a temporary sediment trap. Although they function well when properly installed, straw bale traps deteriorate rather rapidly. One means of prolonging the service life of the trap is by using wire-tied bales rather than those tied with twine. When only twine-tied bales are available, the same effect can be achieved by securely wrapping them with sturdy wire at the location of the twine.

In constructing the trap, the bales are laid on their sides and staked in place. At least two wooden or metal stakes are driven through each bale and into the ground.

As in the case of sandbag traps, piping beneath the structure can render the trap ineffective. To prevent this, the straw bales are also set in a trench excavated to a depth of at least six inches and excavated soil is compacted along the upstream face.

Like all other sediment traps, straw bale and sandbag traps also require periodic inspection and very prompt maintenance if they are to continuously function. Again, sediment removal does not mean shoveling

the sediment off to one side where the next storm will send it directly back into the drainage system. Instead, properly dispose of it in a safe area.

Straw bales can also be used to provide a sediment barrier along the downhill perimeters of small graded sites where area restrictions or other factors prevent the use of other practices. When used in this manner, the bales provide a barrier that slows and filters overland flow.

In constructing a straw bale barrier, the bales are placed in the same manner as prescribed for straw bale traps used in ditches and other small waterways.

Excavated Sediment Trap

Another means of trapping sediment before it enters the storm drainage system is to excavate a pit on the upstream side of the inlet. As in the case of all of the other traps, its function is to temporarily detain the runoff and thereby allow some of the sediment to settle out. This type of trap costs very little to construct in that it makes use of existing structures. The only additional cost incurred is in excavating the pit.

Sediment Basins

Sediment basins are the most effective structures for trapping sediment. They are used on large construction sites where heavy concentrations of both runoff and sediment are anticipated. There are two types of sediment basins – the dry basin and the wet basin. Both are constructed by damming a waterway. Dry sediment basins are constructed on waterways that flow only during storms. Wet basins, on the other hand, are constructed on both intermittent and permanent waterways.

Dry basins and, in most instances, wet basins are drained by a standard metal riser pipe open at the top to handle runoff at a controlled rate during storms. In dry basins, perforations are provided along the pipe to prevent the structure from permanently ponding water. An anti-vortex plate and trash rack are attached at the top of the riser pipe. Their purpose is to increase the intake capacity of the pipe and at the same time to minimize the possibility of trash blockage.

For safety reasons, the top of the riser must be positioned properly. In small basins, the top of the pipe must be at least one foot below the crest of the dam. When an emergency spillway is required, the distance between the top of the dam and the crest of the emergency spillway must also be at least one foot. Failure to adhere to these specifications is likely to result in overtopping during heavy storms and breaching of the dam.

The bottom of the riser pipe is connected to a metal horizontal drain pipe, called a barrel, that conducts the water through the earthen dam. Proper bonding between the structure and the barrel is also very essential to the proper performance of the structure as well as safety. Failure to provide adequate bonding leads to piping failure. This is the flow of water, and resulting erosion, along the outside of the barrel. A cavity at the base of the riser pipe is the tell-tale evidence of such failure.

A formal design by an engineer or other similarly qualified individual is required to properly size the sediment basin and all of its components to the drainage area emptying into the basin. Another reason for this requirement is safety. The failure of larger impoundments could lead to costly property damage and even loss of life.

Close control must also be provided to insure that proper construction practices are employed. Only suitable soils must be used to construct the dam and a high degree of compaction must be achieved.

Before constructing a sediment basin, it is advisable to consult the state and local regulations governing their design and construction. One can obtain these regulations from the local soil and water conservation district, county or city public works department, or the state pollution control agency.

Periodic cleaning is essential to the successful functioning of a sediment basin. Many sediment basins are well-conceived, designed, and constructed, but fail to perform their required function because of the absence of follow-up maintenance. To prevent this from happening, it is essential that the erosion and sediment plan incorporate methods for determining when a basin has filled to its capacity and strong language as to the immediate requirement for cleanout once this occurs.

To assist the foreman and inspector in determining when cleaning is required for a dry basin, a marking should be made on the riser pipe to indicate the maximum allowable sediment level in the structure.

Cleaning of a sediment pond is a costly operation requiring heavy equipment and an elaborate scheme to dispose of the excavated sediment in a manner that will prevent it from being reintroduced into the drainage system.

Dry sediment basins are usually cleaned with a backhoe or a dragline. Smaller basins having firm foundations are sometimes cleaned with front-end loaders. For wet basins or sediment ponds, it is sometimes necessary to use portable dredges.

APPENDIX C

SAMPLE AUDIOVISUAL SCRIPT

PART I - CONTROL OF SEDIMENT
GENERATED ON CONSTRUCTION SITES

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
1.	Music up and under. Voice over loudspeaker: 30 seconds to launch and counting (pause)	Slide: ROCKET ON LAUNCH PAD
2.	25 . . . 24 . . ., on board computer indicates malfunction in ground-to-air communications recorder. Switch to first back-up system.	
3.	Computer now indicates recorder functioning normally. Continue with launch.	Slide: CONTROL ROOM
4.	5 . . ., 4. . ., 3. . ., 2. . ., 1. . .	
5.	blastoff. (sound effect rocket blasting off)	Slide: ROCKET GUSHING FLAMES

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
6.	Sound effect and music.	
7.	Sound effect and music under	
8.	As in the exploration of space, here on earth man has learned the value of having good back-up systems or defenses, should a problem arise.	Slide of earth from space.
9.	In this program we are going to learn about the systems or defenses used to control sediment generated on construction sites.	Title Slide: CONTROL OF SEDIMENT GENERATED ON CONSTRUCTION SITES Part I
10.	By controlling sediment, we mean trapping in on the construction site as near to its point of origin as possible.	Slide showing erosion trapped at the construction site. 3-33 (Slide number)

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
11.	Indirectly, we think of erosion control practices as doing this, in that they are designed to reduce soil erosion, which is the source of sediment.	Slide of an erosion control practice. 19-46
12.	Remember however we can only expect reasonable erosion control,	Slide of 2nd erosion control practice SUPER Reasonable Control 17-72
13.	because even with the best plan, some erosion must be anticipated and as a result some sediment generated.	Slide showing a small amount of sediment which was generated even though erosion plan was used. 4-36
14.	In an erosion and sediment control plan, two separate systems or defenses against sediment damage are established.	Simple art CONTROL PLAN #1 #2 SEDIMENT
15.	The first defense is erosion control . . .	Slide of erosion control practice Super EROSION CONTROL 14-49

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
16.	It reduces the amount of sediment which will be generated.	Slide of soil interceptor dike 10-19
17.	The second defense is sediment control . . .	Slide of sediment control device Super Sediment control 3-2
18.	which prevents much of the sediment from leaving the construction area.	Slide of straw bale barrier 3-80
19.	To be fully effective in preventing costly sediment damage and at the same time . . .	Slide of sediment damage to pond 4-69
20.	prevent ugly erosion and minimize the loss of soil, both defenses must be used.	Slide of erosion. AG-57

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
21.	How do we keep this sediment from damaging the environment?	Slide showing a mass of sediment in roadway ditch 4-44
22.	By using vegetative and structural practices, some very simple,	Slide of straw bale trap 3-61
23.	and others more complicated, that trap most of the sediment before it leaves the construction site.	Slide of structural practice Super: STRUCTURAL PRACTICES 3-76
24.	We are now going to examine some of the principles involved in controlling sediment.	Title Board. PRINCIPLES FOR CONTROLLING SEDIMENT
25.	Sediment is trapped by slowing the flow of water.	Slide of sediment trap spreading the water. 3-14

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
26.	By slowing, the ability of the water to transport sediment is reduced and sediment settles out of suspension.	Slide showing sediment which has settled out of suspension. 3-167
27.	The amount of sediment removed from the runoff is dependent upon 3 factors: first the speed that water flows through the trap . .	Slide of water flowing through trap. Super SPEED OF FLOW 3-84
28.	Second, the length of time the water is detained . . .	Slide of water in trap. Super TIME DETAINED 3-88
29.	And third, the size and weight of the sediment particle carried into the trap.	Photo -- close-up of water -- showing sediment particles in water. 3-172
30.	With regard to the first two factors, the slower the flow of water, and the longer it is detained, the greater the quantity of sediment deposited.	Title Board: 1. Speed of Flow 2. Time Detained

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
31.	The size and weight of the sediment particles determine the speed at which they settle out of suspension. The larger and heavier a particle, the faster it settles out.	ART: Large pebble and small pebble falling in water.
32.	Efficience of sediment trapping is expressed as the percentage of sediment removed from the runoff.	TB $\text{Efficiency} = \frac{\text{Trapped Sediment}}{\text{Total Sed. Runoff}} \times 100\%$
33.	Let's stop at this point and go to Question 1 in your workbooks. (STOP)	Open workbook to page 1.
34.	Now that we've reviewed the basic principles governing the function of sediment traps, let's look at some of the practices used to trap sediment.	Slide of sediment pond 3-83
35.	Various types of vegetative buffers are used. These are: •Natural vegetative buffers •Graded vegetative buffers •Contour stripping •Woodland areas •Sod inlet filters	TB Natural vegetative buffers Graded vegetative buffers Contour stripping Woodland areas Sod inlet filters

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
36.	Leaving a vegetated buffer at the base of a steep slope is an effective means of trapping sediment.	Slide of Buffer at Base of Steep Slope 9-22
37.	This involves preserving a strip of natural vegetation along the sides of the waterway to slow and filter overland flow coming from higher-lying graded areas. This is one of the more effective and economical methods of removing sediment from overland flow.	Slide of natural vegetative buffer area along a stream. 25-2
38.	The need for preserving natural buffer areas must be recognized at the planning and design stage of development and these areas must be prominently displayed on the construction plans as off limits to all construction activity.	Slide - men at drawing board.
39.	Except for essential roadway crossings, no construction must be allowed within the buffer area.	Slide of utility construction
40.	Vegetation damaged by uncontrolled construction activity, whether it be grading practices, construction traffic or other means, cannot efficiently filter overland flow.	Hold frame 39 25-33

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
41.	Good planning by the engineer and careful grading by the contractor could have preserved a protective buffer along this stream and prevented serious sediment pollution. Instead, all of the vegetation was destroyed along the stream bank and the spoil from the utility excavation was pushed into the stream.	Slide of utility construction along a stream. 25-20
42.	Where it is not practical to preserve natural vegetated buffers or where they do not exist, provisions should be made for the construction of a buffer.	Slide of Sediment deposited on buffer. 9-17
43.	Planning for construction of buffers must be done during early design stages.	Slide of contractor on site checking the exact location of a buffer. 9-35
44.	The flatter and the longer the buffer area can be made, the more sediment it will retain. A positive grade of two percent will provide controlled spreading and runoff.	Slide of long flat buffer area. 9-10
45.	Timely establishment of vegetation on the buffer is a must to provide effective sediment trapping.	Slide of vegetative buffer area Super VEGETATIVE BUFFER 9-6

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
46.	A Thick stand of grass slows the overland flow and filters out sediment. In addition to filtering the flow . . .	Slide of sediment trapped by a buffer 9-18
47.	the vegetation allows more water to be absorbed by the soil and thus decreases the ability of the runoff to transport sediment.	Slide showing close up of sediment trapped by grass 9-13
48.	This flattened slope and grass are very effective in trapping sediment from the overland flow coming off the graded area.	Slide of sediment trapped by grass below a graded area. 9-3
49.	Staged grading is a means of providing for the establishment of a vegetative buffer along a waterway.	Slide of sodded drainage way adjacent to a graded area. 14-34
50.	Here a waterway was constructed and stabilized with vegetation prior to the beginning of roadway construction. The resulting vegetative buffer will filter the runoff coming from the denuded roadway area.	Another slide of sodded drainage way adjacent to graded area. 9-4

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
51	This roadway construction site reflects very poor planning on the part of the engineer. The channel realignment and buffer strip were constructed before the embankment in the foreground.	Slide of grassed embankment above a denuded buffer strip and channel 5-19
52.	The buffer strip was not vegetated prior to construction of the embankment.	Hold frame 51 5-19
53.	By failing to promptly vegetate the buffer strip, thousands of tons of sediment were washed into the lower-lying waterway.	Slide of sediment washed into waterway. 5-24
54.	The heavy deposition of sediment in the channel forced the stream to meander and erode the bank. As a result, additional sediment was introduced into the waterway.	Slide of sediment-clogged channel and resulting bank erosion. 5-23
55.	It's time for a review. Open your workbooks and answer question 2.	Question 2

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
56.	Contour stripping involves the establishment of strips of dense vegetation, along the ground contour at regular intervals up the slope.	Slide of vegetative contour strips. Art
57.	These buffer strips slow the flow and reduce the amount of runoff, thereby reducing erosion, while at the same time trapping much of the sediment generated from unpreventable erosion.	Slide of contour farming
58.	The use of a sodded buffer near the base of this short slope serves the same function as contour strips.	Slide of vegetative "Right-of-way" buffer. 3-104
59.	The thick mat of litter covering natural woodland areas also provides a high degree of filtering action, as well as aiding in the absorption of runoff.	Slide of woodland litter 1-197
60.	Considerable care must be exercised, however, in utilizing woodland areas for trapping sediment.	Slide of woodland area 1-135

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
61.	The deposition of a couple of inches or more of sediment around a tree may reduce the oxygen supply to the shallow feeder roots to such an extent that the tree will die.	Slide of sediment deposition in a woodland area. 4-9
62.	It is best to use such areas only for the filtering of overland flow and not for filtering concentrated flow containing heavy amounts of sediment.	Slide showing heavy deposition in wooded area. 4-7
63.	Remember, it is a simple matter to re-establish a cover of grass destroyed by sedimentation, but not so a stand of trees.	Slide of tree damage from sediment deposition. 4-10
64.	A vegetative practice used at storm drain inlets is the sod inlet filter.	Slide showing sod inlet filter Super: Sod Inlet Filter 3-97
65.	This filter is made up of pads of sod placed around the storm drain inlet. It works on the same principle as the vegetative buffer.	Slide of sod inlet filter Hold frame 64

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
66.	The grass slows the flow of water into the inlet and filters out appreciable amounts of sediment.	Close up on inlet in action. 3-103
67.	The size of the sodded area is varied, depending upon the amount of runoff expected at the inlet.	Slide of large sodded inlet filter area. 3-59
68.	This practice should only be used to handle light concentrations of sediment. It can best be used after final grading is complete and during the establishment of a vegetative cover.	Slide of sod inlet filter 3-107
69.	Go now to Quetsion 3.	Questions 3
70.	Because of its low, dense growth and other factors, grass is the best vegetative filter material. Thick, low-growing legumes such as white or red clover are also effective filters.	Vegetative buffer 9-19

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
71.	Even during the dormant winter months, the mat provided by the dead foliage still slows the flow of runoff and traps sediment before it reaches the waterway.	Slide showing mat of dead foliage like legumes. 16-90
72.	Once the flow becomes concentrated, as it does in ditches and other waterways, the trapping of sediment becomes much more difficult and expensive.	Slide of concentrated runoff carrying sediment. 4-31
73.	In addition to vegetative practices, structural practices must be utilized to prevent sediment from entering the natural drainage system.	Gravel inlet filter 3-74
74.	Up to this point we've learned about the principles of trapping sediment.	Slide of sediment trapped in a vegetative buffer 3-140(1)
75.	We learned that the amount of sediment removed from runoff water is dependent upon three factors, the speed that water flows through the trap . . .	Slide of sediment in urban pond 3-168

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
76.	The length of time the water is detained . . .	Sediment basin 3-144
77.	And the size and weight of the sediment particle carried into the trap.	Slide of sediment bedload 3-171
78.	We also looked at the vegetative practices for controlling sediment, including	Slide of sediment deposited on a buffer 9-16
79.	natural vegetative buffers . . .	Slide of natural vegetative buffer 9-2
80.	graded vegetative buffers . . .	Same slide as # 36. 9-22

AUDISCAN PROGRAM

SCRIPT

Client: Hittman

Program: Lesson #8

Frame	Narration	Visuals
81.	Woodland areas and sod inlet filters.	Slide of sod inlet filter 3-97
82.	In part two we'll learn about the structural practices for controlling sediment on the construction site. But first, let's take a break.	Slide of sediment basin 3-86
		END OF PART I

APPENDIX D

SAMPLE AUDIOVISUAL WORKBOOK

CONTROL OF SEDIMENT GENERATED ON CONSTRUCTION SITES

WORKBOOK

To be used in conjunction
with the audio-visual program

ACKNOWLEDGEMENT

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CONTENT

I. BASIC PRINCIPLES OF CONTROLLING SEDIMENT

II. VEGETATIVE PRACTICES

- A. Natural Vegetative Buffers
- B. Graded Buffers
- C. Contour Stripping
- D. Woodland Areas
- E. Sod Inlet Filters

III. STRUCTURAL PRACTICES

- A. Filters and Dikes
  - 1. Gravel Inlet Filter
  - 2. Interceptor Dike
- B. Sediment Traps
  - 1. Sandbag Trap
  - 2. Straw Bale Trap
  - 3. Straw Bale Barrier
- C. Sediment Basins
  - 1. Dry
  - 2. Wet - Sediment Pond

IV. REVIEW QUIZ

I. BASIC PRINCIPLES OF CONTROLLING SEDIMENT

A. Erosion control is the first line of defense. It reduces the amount of sediment that will be generated.

B. Sediment control is the second line of defense. It prevents much of the sediment from uncontrollable soil erosion from leaving the construction site.

C. Sediment traps are designed to slow the flow of water. This reduces the ability of the water to transport sediment, and the sediment settles out of suspension.

D. The amount of sediment removed from the runoff is dependent upon these three factors:

1. Speed that the water flows through the trap.
2. Length of time the water is detained.
3. Size and weight of the sediment particle carried into the trap.

The slower the flow of water and the longer it is detained, the greater will be the quantity of sediment deposited. The size and weight of the sediment particles determine the speed at which they settle out of suspension. The larger and heavier a particle, the faster it settles out.

E. Efficiency of sediment trapping is expressed as the percent of sediment removed from the runoff.

$$\% \text{ Efficiency} = \frac{\text{Amount trapped}}{\text{Total Load}} \times 100$$

II. VEGETATIVE PRACTICES

A. Natural Vegetative Buffers

1. A vegetative buffer at the base of a steep slope is an effective means of trapping sediment.
2. This involves preserving a strip of natural vegetation along the sides of a waterway to slow and filter overland flow coming from higher-lying graded areas.
3. This is one of the more effective and economical methods of removing sediment from overland flow.
4. Except for essential roadway crossings, no construction should be allowed within the buffer area.

B. Graded Buffers

1. Provisions for construction must be made during early design stages of development.
2. The flatter and longer it is, the more sediment it will retain.

3. A positive grade of at least two percent should be provided to prevent ponding.
4. Timely establishment of vegetation on the buffer is a must in order to provide effective sediment trapping.

C. Contour Stripping
1. A method borrowed from the farmer.
2. It is used to break the flow of runoff on long hillsides.
3. It involves the establishment of strips of vegetation, usually grass sod, along the ground contour at regular intervals up the slope.
4. These strips slow the flow and reduce the amount of runoff, thus reducing erosion and trapping much of the sediment generated from unpreventable erosion.

D. Woodland Areas
1. Woodland litter can provide a high degree of filtering action as well as aiding in the absorption of runoff, but care must be exercised because the deposition of a few inches of sediment around a tree can cause it to die.

2. Use woodland areas only for the filtering of overland flow.

E. Sod Inlet Filter

1. Made up of pads of sod placed around the storm drain inlet.
2. The grass slows the flow of water into the inlet and filters out appreciable amounts of sediment.
3. The size of the sodded area is varied depending upon the amount of runoff expected at the inlet.
4. This practice should only be used to handle light concentrations of sediment.
5. Best used after final grading is complete and during the establishment of a vegetative cover.

III. STRUCTURAL PRACTICES

A. Filters and Dikes

1. Gravel Inlet Filter

a. Used at storm drain inlets.

b. Made of coarse gravel or crushed stone.

c. Will temporarily impound runoff.

d. Provides a certain amount of filtering action.

e. Is highly resistant to erosion.

f. Standard concrete building blocks are placed on the inside of the gravel filter to keep stones from being washed into the storm drain inlet.

g. The configuration of the filter will depend upon the type of inlet being protected.

h. Prompt maintenance is very essential.

2. Interceptor Dike

a. Used on roadway rights-of-way.

b. Intercepts runoff coming down the graded roadway and diverts it into storm drain inlets protected by gravel filters.

c. Used with gravel inlet filter to increase trapping efficiency.

d. Helps control erosion by diverting runoff away from the graded surface.

B. Sediment Traps

1. Sandbag Sediment Trap

   a. A quick and economical method of temporarily disrupting flow and trapping the coarser sediment particles.

   b. A high degree of trapping efficiency can be achieved by positioning these barriers at regular intervals along the ditch.

   c. Bags are filled with soil or stone and stacked in an interlocking fashion which provides additional strength for resisting the force of the flowing water.

   d. Piping is a major cause of the failure of many temporary sediment traps.

   e. The sandbags should be set in a trench at least six inches in depth. This will greatly reduce the chance of piping failure.

   f. Inspection and prompt maintenance is required.

2. Straw Bale Sediment Trap

   a. Fast and economical temporary trap.

   b. Made of bales of straw or hay.

   c. Deteriorates rapidly.

   d. Can increase trap effectiveness by using wire-tied bales.

e. When constructing the bales are laid on their sides and staked into place.

d. Piping can render the trap ineffective.

f. Straw bale trap should be entrenched at least six inches and excavated soil should be compacted along the upstream face.

g. Inspection and prompt maintenance is required.

3. Straw Bale Perimeter Barrier

a. Used to provide a sediment barrier along the downhill perimeters of small graded sites where area restrictions or other factors prevent the use of other practices.

b. Close inspection is required.

4. Excavated Sediment Trap

a. Its function is to temporarily detain the runoff and thereby allow some sediment to settle out.

b. Costs little to construct.

c. Once the sediment-yielding area is stabilized, the pit area can, in some instances, be filled in with soil and covered with sod.

C. Sediment Basins

1. Sediment basins are the most effective structures for trapping sediment.
2. Used on large construction sites where heavy concentrations of both runoff and sediment are anticipated.
3. Dry Sediment Basin
   a. Designed to only temporarily impound runoff during rainfalls.
   b. It is drained by a standard metal riser pipe with perforations which allow the water to be released at a controlled rate.
   c. It requires a formal design for size and safety reasons.
   d. Only suitable soils must be used to construct the dam.
   e. A high degree of compaction must be achieved.
   f. Proper positioning of the riser pipe is essential to proper performance.
   g. Piping failures are too common in temporary dry sediment basins.

h. Consult state and local regulations governing their design and construction prior to starting to build one.

i. Periodic cleaning is essential if the basin is to do its job.

(1) usually cleaned with a backhoe or dragline

(2) smaller basins with firm foundations are sometimes cleaned with front-end loaders

j. Construction specifications for the basin must specify the required freeboard - the vertical distance between the crest of the emergency spillway at the top of the dam.

k. Failing to provide enough freeboard will result in overtopping during heavy storms and breeching of the dam.

4. Wet Basin - Sediment Pond

a. Used when it becomes necessary to dam permanent streams in order to trap sediment.

b. On large residential developments, recreational impoundments also function as sediment traps.

c. Requires a formal design and strict construction control for safety reasons.

d. Cleaning a wet sediment basin is costly.

   (1) dragline is used.

   (2) portable dredges used on large ponds.

QUESTIONS 1

Fill in the blanks

1. E_____ c_____ is the first line of defense. It _____ the amount of sediment that will be generated.

2. S_____ c_____ is the second line of defense.

3. Sediment traps are designed to slow the flow of _____.

4. The amount of _____ removed from the runoff is dependent upon three factors:
   a. S_____ that the water flows through the t_____.
   b. L_____ of time the water is d_____.
   c. S_____ and w_____ of the sediment particles carried into the trap.

QUESTIONS 2

Multiple Choice

1. The best vegetative filters are

   a. legumes
   b. grasses
   c. trees
   d. periwinkle.

   answer(s)_____

2. No construction should be allowed within a buffer area

   a. at all.
   b. except for essential roadway construction.
   c. except for residential construction.
   d. except for normal roadway construction.

   answer(s)_____

True or False

_____1. Leaving a buffer at the base of a steep slope is an effective means of trapping sediment.

_____2. A buffer speeds the flow of runoff coming off a steeper slop

_____3. The flatter and longer a buffer area, the more sediment it will retain.

_____4. Adding vegetation to a buffer area increases its ability to trap sediment.

_____5. To prevent ponding, a positive grade of at least two percent should be provided.

_____6. A natural vegetative buffer is one of the more effective and economical methods of removing sediment from overland flow.

QUESTIONS 3

1. Contour stripping is a method borrowed from

   a. the farmer.
   b. the contractor.
   c. nature.
   d. the foreman.

   answer(s)_____

2. The use of a vegetative buffer near the base of a highway slope serves the same function as

   a. the storm drain.
   b. the top of cut.
   c. the interceptor dike.
   d. the contour strips.

   answer(s)_____

3. The sod inlet filter

   a. should only be used to handle light concentrations of sediment.
   b. is made up of pads of sod.
   c. is best used after final grading is complete.
   d. all of the above.
   e. none of the above.

   answer(s)_____

QUESTIONS 4

Fill in the blanks

1. S_____ p_____ are employed on construction sites to trap sediment.

2. The _____ _____ filter is used at storm drains.

3. The gravel inlet filter is h_____ r_____ to erosion.

4. The configuration of the filter will depend upon the t_____ of i_____ being protected.

5. Using an i_____ dike with a gravel inlet filter i_____ trapping efficiency.

QUESTIONS 5

True or False

_____1. The sandbag sediment trap is a quick and economical method of temporarily disrupting flow and trapping the coarser sediment particles.

_____2. Piping is a major cause of failure of many temporary sediment traps.

_____3. Straw bale sediment traps last indefinitely.

_____4. Close inspection is not required of a straw bale perimeter barrier.

_____5. The function of an excavated sediment trap is to temporarily detain the runoff.

_____6. The most effective structures for trapping sediment are straw bale barriers.

QUESTIONS 6

Multiple Choice

1. A dry sediment basin is

   a. designed to only temporarily impound runoff.
   b. drained by a metal riser pipe.
   c. requires a formal design.
   d. all of the above.
   e. only a and c.

   answer(s)_____

2. The vertical distance between the top of the dam and the crest of the spillway is known as the

   a. sediment valve.
   b. freeboard.
   c. safety factor.
   d. ruler.

   answer(s)_____

3. The odd looking device at the top of the riser pipe is called

   a. a barrel.
   b. an antivortex plate and trash rack.
   c. an emergency spillway.
   d. none of the above.

   answer(s)_____

QUESTIONS 7

1. Erosion control r_____ the amount of runoff that will be generated.

2. Sediment control is the s_____ line of defense.

3. The three factors upon which the amount of sediment removed from the runoff is dependent are:

   a. S_____ that the water flows through the t_____.

   b. L_____ of time the water was d_____.

   c. S_____ and w_____ of the sediment particles carried into the trap.

4. Leaving a v_____ b_____ at the base of a steep slope is an effective means of trapping _____.

5. P_____ a natural buffer is one of the more effective and economical methods of removing sediment from overland flow.

6. The ability of a graded buffer area to trap sediment is improved by adding v_____.

7. The last vegetative filter is _____.

8. Woodland areas should be used only to filter o_____ flow.

9. C_____ s_____ is a method borrowed from the farmer.

10. It is used to break the f_____ of r_____ on long hillsides.

11. The use of a v_____ b_____ near the base of a highway slope serves the same function as _____ strips.

12. G_____ b_____ are employed on construction sites to retain or trap sediment.

13. The sod inlet filter should be used to handle l_____ concentrations of sediment.

14. The g_____ i_____ filter is highly resistant to erosion.

15. The configuration of the filter will depend upon the t_____ of i_____ being protected.

16. The interceptor dike is used on r_____ rights of way.

17. Straw b_____ and s_____ traps are quick and economical methods of temporarily disrupting flow.

18. P_____ is a major cause of the failure of many temporary sediment traps.

19. Piping failure is reduced in temporary sediment t_____ by placing either the s_____ traps or s_____ b_____ traps a minimum of _____ inches in the ground.

20. A straw bale perimeter barrier is used to provide a s_____ barrier along the downhill perimeter of small graded sites, where area restrictions or other factors prevent the use of other practices.

21. An e_____ sediment trap c_____ l_____ to construct.

22. S_____ b_____ are the most effective structures for trapping sediment.

23.

23. A dry sediment basin is designed to only t_____ impound r_____ during rainfalls.

24. A dry sediment basin is drained by using a standard metal r_____ p_____ with p_____, which allow the water to be released at a controlled rate.

25. Both wet and dry sediment ponds must be

a. vegetatively stabilized.
b. emptied.
c. washed.
d. none of the above.

answer(s)_____

APPENDIX E

SAMPLE AUDIOVISUAL SUPERVISOR'S MANUAL

CONTROL OF SEDIMENT GENERATED ON CONSTRUCTION SITES

SUPERVISOR'S MANUAL

To be used in conjunction
with the audio-visual program.

ACKNOWLEDGEMENT

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CONTROL OF SEDIMENT GENERATED

ON CONSTRUCTION SITES

PURPOSE

The purpose of the Instructor's Manual is to help you make the best use of the Audiscan filmstrip and workbook for the self-instructional audiovisual lesson on Control of Sediment Generated on Construction Sites.

OBJECTIVE

The objective of this instructional package is to promote better understanding among erosion and sediment control specialists as to:

- the kinds of sediment control structures and their functions.
- the importance of proper construction and regular maintenance of sediment control structures.

PREPARATION FOR PRESENTATION

This instructional package is designed both for self-study and for group presentation. For an effective smooth-running group presentation, plan well in advance. Have the Audiscan projector, the screen and seating set up. Have the workbooks ready for distribution.

Before presenting the filmstrip, preview it and read the workbook so that you can have their contents clear in your mind and can answer questions. Previewing the filmstrip also assures you that the Audiscan projector is working properly.

Finally, prepare the audience. Explain the objectives of the instructional package. Describe the sequence of events of the presentation. Tell them that there will be a short review at the end of the program to help them discover how well they have understood the filmstrip.

PRESENTATION

The filmstrip can be viewed continuously. However, because of the quantity and detail of the information presented, it is suggested that you view it in sections. The Audiscan projector will automatically stop at review points. These automatic stops are built-in for question-and-answer periods. Always make sure everyone understands each part of the filmstrip before going on to the next part. The Audiscan projector will have to be restarted manually after each stop.

PROJECTOR OPERATION

To operate the Audiscan audiovisual projector insert the appropriate cartridge with the arrow up into the side of the machine. Turn the machine on using the Volume On/Off control. To start the program, press the Start switch. Focus as desired. To restart the projector, after it has stopped for review questions, push the start portion of the Program Hold/Start switch. Should the audio and visual portions of the filmstrip become unsynchronized for any reason, synchronization may be re-established by holding the Lock switch to the left and at the same time depressing either the Film Hold or Film Advance switch as appropriate.

SEQUENCE OF EVENTS

Welcome the group and prepare them as previously described. Tell them that a workbook will be distributed. Add that it was prepared to expand the information in the filmstrips. Also, inform them of the built-in review periods.

Show Part I of the program Control of Sediment Generated on Construction Sites. Review the basic functions of sediment traps. Be sure the trainees are familiar with the vegetative sediment control practices.

Show Part II. Stress the importance of maintenance for all sediment control structures. Make sure the trainees understand the important construction criteria for sediment basins.

IDEAS FOR DISCUSSION

1. What do we mean by "control of sediment generated on construction sites"?
2. Why can we only expect reasonable erosion control?
3. How do we keep sediment from damaging the environment?
4. Why must both defenses be used?
5. Why is good planning important in the preserving of a buffer area?
6. How is the ability of a buffer to trap sediment improved?
7. Explain the use of contour strips.
8. Why must care be exercised in utilizing woodland areas for trapping sediment?
9. Discuss the use of grass and legumes as filters.
10. Discuss the construction of the sod inlet filter.
11. Discuss the construction of the gravel inlet filter.
12. Why is maintenance so important?
13. How is the possibility of piping reduced on temporary sediment traps?
14. How is a straw bale perimeter barrier used?
15. How can the life of a straw bale sediment trap be prolonged?
16. How important is maintenance with temporary sediment traps?

17. Describe some ways sediment basins are cleaned.

18. What is the importance of consulting local and state regulations before constructing a sediment basin?

19. What is a common cause of the failure of dry temporary sediment basins?

20. Why is the maintenance of a sediment basin so important?

Control of Sediment Generated

on Construction Sites

WORKBOOK - ANSWERS

Questions 1

1. Erosion Control, reduces
2. Sediment Control
3. water
4. sediment
   Speed, trap
   Length, detained
   Size, weight

Questions 2

1. b
2. b
3. a
4. d
5. d

Questions 3

1. True
2. False
3. True
4. True
5. True
6. True

Questions 4

1. Structural practices
2. gravel inlet
3. highly resistent
4. type, inlet
5. interceptor, increases

Questions 5

1. True
2. True
3. False
4. False
5. True
6. False

Questions 6

1. d
2. b
3. b
4. d

Questions 7

1. reduces
2. second
3.
   a. Speed, trap
   b. Length, detained
   c. Size, weight
4. vegetative buffer, sediment
5. Preserving
6. vegetation
7. grass
8. overland
9. Contour stripping
10. flow, runoff
11. vegetated buffers, contour
12. graded, buffers
13. light
14. gravel inlet
15. type, inlet
16. roadway
    rights of way
17. bale, sandbag
18. Piping
19. traps, sandbag, straw bale, six
20. sediment
21. excavated, cost little
22. Sediment basins
23. temporarily, runoff
24. riser pipe, perforations
25. a

APPENDIX F

PARTICIPANT PROFILE FORM

No. _____

PARTICIPANT PROFILE

1. Where were you brought up (lived most of your life) before you were 18?

   a. On a farm or ranch ☐

   b. In the country, but not living on a farm or ranch ☐

   c. In a town (population under 10,000) ☐

   d. In a city ☐

2. How many years of schooling have you completed (please circle the highest level(s) you have finished)?:

High School	Trade School or Military Service School	College
1 2 3 4	1 2 3 4	1 2 3 4

   If you attended trade school, what was your major subject?:

   _____

   If you attended college, what was your major subject?:

   _____

3. Please list any other formal courses or classes you have attended which are related in any way to the general subject of erosion and sediment control:

   _____

   _____

4. What is your occupation?:

   a. Foreman ☐

   b. Inspector ☐

   How many years have you been engaged in activities related to construction and/or inspection? _____

5. What is your age?:

a. 20-29 ☐
b. 30-39 ☐
c. 40-49 ☐
d. 50-59 ☐
e. over 60 ☐

6. What is your present yearly income from all sources?:

a. Less than 5,000 ☐
b. 5,000 to 9,999 ☐
c. 10,000 to 14,999 ☐
d. 15,000 to 19,999 ☐
e. Greater than 20,000 ☐

7. What are your main interests and activities outside your job?:

_____

_____

_____

8. What clubs, groups, or civic organizations do you or have you belonged to?:

_____

_____

_____

_____

APPENDIX G

EVALUATION QUESTIONS

EVALUATION QUESTIONS

Based on

EROSION AND SEDIMENTATION

and

THE GOAL, OBJECTIVES AND PRINCIPLES

OF EROSION AND SEDIMENT CONTROL

Instructions:

1. Fill in blanks where indicated
2. Circle either true or false at the end of statements
3. In multiple choice questions place the letter or letters for the correct answer on the line indicated. More than one alternative may be correct.

1. The process by which the land surface is worn away by the action of wind, water, ice or gravity is termed _____.

2. The process by which the detached particles are transported and deposited is called _____.

3. Given experience and a sincere attitude, you can do an effective and reasonable job of protecting the land and water resources.

   True False

4. Erosion and sedimentation are:

   a. One and the same thing

   b. Cause different types of environmental damage

   c. Require different controls

   Answer(s) _____

5. It is acceptable if we can control 50% of the erosion and sedimentation resulting from a construction site.

   True False

6. Slope steepness, surface roughness, and the amount and intensity of rainfall are factors that control the

   a. amount of rain in a watershed
   b. speed at which runoff flows down a slope
   c. speed at which rills turn to sheet erosion

Answer(s)_____

7. The destruction of natural v_____ and the reshaping of the ground s_____ are contributing factors to erosion in urbanizing areas.

8. Stream gaging is a method of determining the amount of flow in a given waterway.

True False

9. The principle factors contributing to the acceleration of erosion in urbanizing areas are:

   a. destruction of natural vegetation
   b. reshaping of ground surface
   c. exposure of subsoils
   d. reduced runoff
   e. placement of impervious features on the soil like paving and buildings.

Answer(s)_____

10. In controlling erosion and sedimentation the office planners are more important than the on-the-ground field personnel.

True False

11. Sediment pollution damages the quality of water and the habitat through which the water flows.

True False

12. Slope steepness is often expressed as p_____ by engineers and planners.

13. To establish a sediment control program we need:

    a. Careful study and planning

    b. Cooperation and involvement

    c. To pave as much of the construction area as possible

    d. Flexibility

Answer(s)_____

14. Natural or g_____ erosion is a relatively slow process, continually taking place.

15. Erosion resulting from man's activities is termed a_____ erosion.

16. Practices used to control erosion are:

    a. special grading, such as surface roughening

    b. constructing long slopes

    c. constructing diversion structures

    d. clearing all trees off the area

    e. using a straw mulch

Answer(s)_____

17. When working on a construction project both contractors and government officials must cooperate and have overall flexibility in applying plans.

True False

18. The presense of organic material in a soil has no effect on a soil's erodibility.

True False

19. Generally, erosion is more severe at the base of a short steep slope than at the base of a long steep slope.

True False

20. While being transported, sediment is divided into two types: s_____ sediment and bedload sediment.

21. The plans developed for a site must be adhered to regardless of problems which develop when work is started.

True False

22. A slope which changes 10 feet vertically in 100 feet of horizontal distance is referred to as a _____ percent slope.

23. In a stream the b_____ sediment is made up of larger and heavier weight particles.

24. A damaging aspect of wind erosion in urbanizing areas is the collection of dust on structures such as buildings and roadways.

True False

25. Erosion due to agriculture is generally (more/less) severe than erosion from urbanizing areas.

26. The removal of a fairly uniform layer of soil from the land surface is known as s_____ erosion.

27. Sediment is undesirable because:

    a. it damages water resources

    b. it increases the flow in streams

    c. it fills the channels so ships can't use the rivers

    d. it kills fish and other aquatic life

Answer(s)_____

28. When the depth of the grooves on a soil slope exceeds four inches the erosion is usually termed _____ erosion.

29. Which of the following factors influence erosion:

    a. amount of rainfall

    b. intensity of rainfall

    c. temperature

    d. frequency of rainfall

Answer(s)_____

30. Overland erosion occurs on denuded slopes as a result of rainsplash and runoff.

True False

31. Wind erosion is usually the largest source of sediment during construction operations.

True False

32. The process by which soils or other surface materials are transported or deposited by the action of wind, water, ice or gravity is s_____.

33. To achieve effective and reasonable control over erosion and sediment caused by man's activities using the best practical combination of procedures, practices and people is the goal of erosion and sediment control.

True False

34. Accelerated erosion in stream channels is brought on by increased r_____ from developing areas and the removal or destruction of natural v_____ along stream banks.

35. The best way to protect the land is to control erosion at its source.

True False

36. From a textural standpoint, soils having large amounts of silt and fine sand, as well as those containing highly expansive clay minerals, are most susceptible to erosion from rain splash and runoff.

True False

37. A w_____ is any natural or artificial drainageway in which waters flow in a definite direction or course either continuously or intermittently.

38. A formula used to measure erosion is the Universal Soil _____ Equation.

39. Normal tillage of the soil will obliterate rill erosion.

True *False*

40. Normal tillage of the soil will obliterate gully erosion.

True *False*

41. The longer rain falls on a given area the more runoff *(increases/decreases)*

*Answer*_____

42. Soil loss is expressed as tons per_____ per year.

43. A good erosion control practice is to break a long slope into a series of short slopes.

True *False*

44. Stream channel erosion includes both stream-_____ and streambank erosion.

45. The five (5) principles of erosion and sediment control are:

a. Apply sediment control practices as a perimeter protecticn to prevent off-site damage.

b. Expose the smallest practical area of land for the shortest possible time.

c. Implement a thorough maintenance and follow-up operation.

d. Apply erosion control practices as a perimeter protection.

e. Apply soil erosion con' ol practices as a first line of defense a inst on-site damage.

f. Apply sediment control practices as a first line of defense against on-site damage.

g. Plan the development to fit the particular topography, soils, waterways and natural vegetation at a site.

h. Expose the minimum area of land for the longest time.

Answer(s)_____

46. Which of the following are Objectives of Erosion and Sediment Control?

a. Establish and maintain a sediment control program.

b. Protect vital land resources from erosion.

c. Protect vital water resources and wildlife from sediment pollution.

d. Provide high quality water for human use.

Answer(s)_____

47. The development of small grooves on a soil slope is termed _____ erosion.

APPENDIX H

EVALUATION OF PRESENTATION FORM

EVALUATION OF PRESENTATION

1. You have experienced an illustrated lecture and an audiovisual presentation on some aspects of erosion control during construction. In the space below, please write what you liked about each style of presentation. Also we are interested in your feeling about the style of presentation, not your feeling about the subject of the presentation.

LECTURE	AUDIOVISUAL
1)	1)
2)	2)
3)	3)

Now please tell us what you did not like about each style of presentation.

LECTURE	AUDIOVISUAL
1)	1)
2)	2)
3)	3)

2. Would you like to go through the same subject again in the audiovisual program?

Yes No

3. Would you like to sit through exactly the same lecture again?

Yes No

4. Do you think that all points discussed in the audiovisual program were suitably illustrated?

Yes No

If you checked No what additional illustrations would you like to see?

_____

_____

5. Could you clearly understand the narrator in the Audiovisual program?

Yes No

6. Could you clearly understand the lecturer?

Yes No

7. Which presentation do you think you learned the most from?

Audiovisual Lecture

Why?

_____

_____

8. If you were given a series of programs to study which of the following methods would you prefer:

   a. Live lecture

   b. Audiovisual in a group situation

   c. Audiovisual -- take programs by yourself

9. Please explain why you selected the method you indicated._____

_____

10. Did you find the questions in the workbook with the audiovisual program were a help in learning?

Yes No

11. Did you have sufficient time to answer the questions in the workbook?

Yes No

12. What was your opinion of the illustrations (cartoons) in the audiovisual program (you may check as many as you wish):

    a. An amusing break
    b. Conveyed a real message
    c. A frivolous distraction
    d. I found it hard to understand the meaning of some of the drawings
    e. I would have liked more of them
    f. Other

13. Were the photographs in the audiovisual presentation clear and understandable?

Yes No

14. Please make any additional comments: